



**Former L.A. Darling Facility**  
**Operable Unit 2**  
**of the**  
**North Bronson Former Facilities Site**  
**Bronson, Michigan**

**Record of Decision**

**September 2008**

**Record of Decision**  
**for the**  
**Former L.A. Darling Facility**

**List of Acronyms and Abbreviations**

ARAR	Applicable or Relevant and Appropriate Requirement
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-Dichloroethene
COPC	Chemicals of Potential Concern
CSF	Cancer Slope Factor
CWA	Clean Water Act
1,1-DCA	1,1-Dichloroethane
1,2-DCA	1,2-Dichloroethane
1,1-DCE	1,1-Dichloroethene
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
MCL	Maximum Contaminant Level
MDEQ	Michigan Department of Environmental Quality
mg/L	Micrograms per Liter
ug/kg	Micrograms per Kilogram (parts per billion)
mg/kg	Milligrams per Kilogram (parts per million)
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPL	National Priorities List
NREPA	Natural Resources and Environmental Protection Act
O&M	Operations and Maintenance
1,1,2,2-PCA	1,1,2,2-Tetrachloroethane
PCE	Tetrachloroethene
ppm	part(s) per million (mg/kg or mg/L)
PRG	Preliminary Remediation Goal
RI	Remedial Investigation
RI/FS	Remedial Investigation / Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
TBC	To-be-considered (criteria)
TCE	Trichloroethene
trans-1,2-DCE	trans-1,2-Dichloroethene
1,1,1-TCA	1,1,1-Trichloroethane
1,1,2-TCA	1,1,2-Trichloroethane
U.S. EPA	United States Environmental Protection Agency

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## **PART 1: THE DECLARATION**

### **Site Name and Location**

The North Bronson Former Facilities Site (United States Environmental Protection Agency (U.S. EPA) Identification Number MIN000508192) addresses contamination at three former industrial facilities in Bronson, Michigan. The three properties include the former Bronson Reel facility, the former L.A. Darling facility and the former Scott Fetzer facility (see Figure 1). These properties historically discharged contaminated industrial wastewaters to the City of Bronson's industrial lagoons. While these former facilities were initially investigated as part of the North Bronson Industrial Area (NBIA) Superfund Site, U.S. EPA elected to manage them as a separate site known as the North Bronson Former Facilities (NBFF) Site.

The former L.A. Darling facility (sometimes referred to as the "Facility") is OU2 of the NBFF Site. The Facility includes approximately two acres of the original industrial property, all areas where contamination from the property has come to be located, and all areas immediately adjacent thereto. The Facility is located in a neighborhood that has both residential and industrial/commercial land uses. Information related to past industrial operations and structures at the former L.A. Darling property is shown on Figure 2. Other than a water tower and some subsurface structures, the property is currently vacant. Soil and groundwater at the site are contaminated with volatile organic compounds (VOCs), metals and cyanide.

This Record of Decision (ROD) selects a final remedial action for contaminated soils and an interim action for contaminated groundwater. A final cleanup plan for contaminated groundwater will be selected in a separate decision document to address broader groundwater contamination that includes overlapping contaminant plumes in the north Bronson area. This remedial action will result in reduced risks to humans and will significantly decrease the mass of VOCs moving into groundwater.

### **Statement of Basis and Purpose**

This is the second ROD issued with respect to the NBFF Site, and the first ROD for NBFF OU2. A ROD was issued in 2006 for the former Bronson Reel facility (NBFF OU1) located approximately two blocks to the west of the Facility.

The streamlined Remedial Investigation (SRI) and Feasibility Study (FS) for the former L.A. Darling facility were completed in 2008 by the L.A. Darling Company. The human health risk assessment (HHRA) determined that worker risks solely from soil exposure are within U.S. EPA's risk range, within which U.S. EPA is authorized to act. However, under any scenario that assumes potable use of groundwater, the carcinogenic risk from groundwater would exceed U.S. EPA's risk range. The Facility is an industrial property and provides a limited and low-quality habitat. Metal concentrations in soil exceed ecological screening criteria.

In July of 2008, U.S. EPA issued its Proposed Plan that contained the recommended Soil and Groundwater Alternatives. In this ROD, U.S. EPA is selecting a final remedial action for Facility soils and an interim remedial action for Facility groundwater in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (in accordance with CERCLA Section 121(a)). The decisions herein are based on the Administrative Record for this Site. Occasional reference is made to specific documents in the Administrative Record where the information is too voluminous to provide here.

U.S. EPA is the lead agency for this project. The State of Michigan, by the Michigan Department of Environmental Quality (MDEQ), which is the support agency for this project, has indicated its concurrence with U.S. EPA's decision for this project. The concurrence letter from the MDEQ will be included with the ROD once it is received.

## **Assessment of Site**

The response action selected in this ROD is necessary to protect the public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment.

### **Description of Selected Remedy**

The selected remedies include a final remedial action to address contaminated site soil and debris and an interim groundwater action to address groundwater contamination at the former L.A Darling facility. The major components of the selected remedies include:

- Excavation and off-site disposal of contaminated subsurface structures, sewers, and USTs;
- Excavation and off-site disposal of contaminated soil, as necessary to reach Michigan Part 201 Industrial and Commercial Direct Contact Criteria and Michigan Part 201 Groundwater Surface Water Interface (GSI) Protection Criteria (for those contaminants that pose a risk of exceeding the GSI criteria in groundwater at County Drain #30 (CD #30)). Verification during remedial design that extent of excavation is sufficient to address potential ecological risks. If contamination (excluding sludge and hot-spot areas) extends below the water table, soil excavation may be limited to the area above the water table;
- Excavation below the water table, using best engineering practices, for sludge and hot-spot areas of contamination;
- Restoration of the site to current grades;
- Construction of an air sparge/SVE treatment system to remove VOC contamination from below the water table;
- Operation, maintenance and monitoring of the air sparge/SVE treatment system;
- Conversion of the air sparge/SVE system to a groundwater extraction/treatment system upon U.S. EPA agreement or upon U.S. EPA direction, in consultation with MDEQ. The determination as to when it is appropriate to move to groundwater extraction and treatment is to be based on air sparge recovery rates and groundwater and soil gas contaminant concentration;
- Operation, maintenance and monitoring of groundwater extraction and treatment system;
- Discharge of treated water to CD #30;
- Placement of a warranty deed restriction on the property to limit land use to industrial/commercial purposes, limit intrusive activities below the water table, and prohibit groundwater use;
- Coordination with the City of Bronson to draft and pass an ordinance restricting groundwater use in areas of groundwater contamination;
- Coordination with the MDEQ Water Bureau, which arranges contractually with the Branch-Hillsdale-St. Joseph Community Health Agency for monitoring of private wells that have the potential to be impacted by groundwater contamination from the former L.A. Darling facility; and
- Monitoring of deed restrictions to ensure that land and groundwater use is consistent with the cleanup levels selected for the Facility.

## **Statutory Determinations**

The selected final soil remedy meets the requirements for remedial actions set forth in Section 121 of CERCLA, 42 U.S.C. § 9621. It is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements (ARARs), is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected final remedy for soils will comply with the location-specific and action-specific ARARs, as well as chemical-specific ARARs.

The selected interim groundwater action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD for NBFF groundwater is signed; complies with those federal and state requirements that are applicable or relevant and appropriate for this limited-scope action; and is cost-effective. Although this interim action is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus supports that statutory mandate. Because this action does not constitute the final remedy for contaminated groundwater at and from the former L.A. Darling facility, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action for NBFF groundwater. Subsequent actions are planned to address fully the threats posed by groundwater conditions at the NBFF Site. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the remedial action. Because this is an interim action ROD, review of this site and remedy will be ongoing as U.S. EPA continues to develop remedial alternatives for the NBFF groundwater.

Because the soil and groundwater remedies will result in hazardous substances on-site above levels that allow for unlimited use and unrestricted exposure, the five-year review requirement applies to this action. U.S. EPA will monitor (or will require the responsible party to monitor) groundwater contaminant levels at the site and the implementation and/maintenance of institutional controls.

## **Community Participation**

U.S. EPA has provided opportunity for public participation and comment in the process leading up to this ROD. The RI Report, FS Report and the Proposed Plan for the former L.A. Darling facility were made available to the public in July of 2008. They can be found in the Administrative Record file, copies of which are available at the information repository maintained at the U.S. EPA Docket Room in Region 5 and at the Branch Library in Bronson. The notice of the availability of these two documents was published in the Coldwater Daily Reporter on July 16, 2008. Approximately 300 copies of the Proposed Plan Fact Sheet were distributed to the community and interested parties. A public meeting was held on August 7, 2008 to present the Proposed Plan to the community. At this meeting, representatives from U.S. EPA and the MDEQ discussed and answered questions about problems at the site and the remedial alternatives. A public comment period was held from July 17, 2008 until August 15, 2008. U.S. EPA's response to comments received during the comment period is included in the Responsiveness Summary, which is part of this Record of Decision.

U.S. EPA received two written comments from private citizens and one oral comment presented by the Bronson City Manager at the public meeting. No faxed comments were received. Comments were also received by e-mail from ITT Industries, a potentially responsible party for the former Bronson Reel Facility. U.S. EPA has reviewed the public comments and determined that there is no information presented that warrants modification of the proposed remedy.


## ROD Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record for this site.

- Chemicals of concern and their respective concentrations. (Section 6.6 on pages 12 and 13, Section 8.1.1 on page 15 explaining that the risk assessment utilized the complete list of contaminants assessed, and Table 1 of Appendix A)
- Baseline risk represented by the chemicals of concern. (Tables 2 and 3 in Appendix A)
- Cleanup levels established for chemicals of concern and the basis for these levels. (Tables 8 and 9 in Appendix A, Section 13.2 on pages 35 and 36, and Section 13.5.2 on pages 38 and 39)
- How source materials constituting principal threats are addressed. (Section 12.0 on page 34)
- Current and reasonably anticipated future land use assumptions and current and future beneficial uses of groundwater used in the baseline risk assessment and ROD. (Section 7.0 on page 14)
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy. (Section 13.2 on pages 35 and 36)
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected. (Tables 10 and 11)
- Key factor(s) that led to selecting the remedy (i.e., describes how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision. (Section 13.1 on pages 34 and 35)

9-22-08

Date



Richard C. Karl  
Director, Superfund Division  
U.S. EPA Region 5

## **PART 2: THE DECISION SUMMARY**

### **1.0 SITE NAME, LOCATION AND BRIEF DESCRIPTION**

The North Bronson Former Facilities Site (United States Environmental Protection Agency (U.S. EPA) Identification Number MIN000508192) addresses contamination at and from three former industrial facilities in Bronson, Michigan. The three properties include the former Bronson Reel facility, the former L.A. Darling facility and the former Scott Fetzer facility (see Figure 1). These properties historically discharged contaminated industrial wastewaters to the City of Bronson's industrial lagoons. While these three facilities were initially investigated as part of the North Bronson Industrial Area (NBIA) Superfund Site, U.S. EPA elected to manage them as a separate site known as the North Bronson Former Facilities (NBFF) Site.

This Record of Decision (ROD) addresses contamination at the former L.A. Darling facility, which has been identified as Operable Unit (OU) 2 of the NBFF Site. The property occupies approximately 2 acres near the intersection of N. Matteson Street and Railroad Street in Bronson (see Figures 1 and 2 in Appendix A to this ROD). The Facility includes the former L.A. Darling property, all areas where contamination from the property has come to be located, and all areas immediately adjacent thereto. Properties around the former L.A. Darling property include residences and industrial/commercial businesses. The former Scott Fetzer facility (OU3 of the NBFF Site) is located across the street, immediately to the west of the L.A. Darling facility. NBFF OU1, the former Bronson Reel facility, is located approximately 2 blocks to the west. The former L.A. Darling facility is currently owned by the City of Bronson.

The former L.A. Darling property is fenced and virtually vacant. Significant structures remaining at the site include a water tower, a water meter board, two underground storage tanks, and concrete slabs. During the fall and winter of 2007/2008, the L.A. Darling Company, the primary Potentially Responsible Party (PRP) for OU2, conducted voluntary "at-risk" soil excavation under U.S. EPA oversight. This excavation allowed for the restoration of Railroad Street through a portion of the property. Road reconstruction was completed in the summer of 2008.

The U.S. EPA was the lead agency for the Remedial Investigation/Feasibility Study and the issuance of the Proposed Plan. U.S. EPA has coordinated closely with the Michigan Department of Environmental Quality (MDEQ) and the MDEQ has provided significant technical support and comment to the work that has been completed.

### **2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES**

#### **2.1 Site History**

The L.A. Darling Company and its predecessors manufactured display fixtures and retail shelving from 1909 to 1967, when their operations at the Facility ceased and the Facility was sold. Operations included chromium and cadmium plating, and degreasing using trichloroethene (TCE). Subsequent owners of the Facility manufactured and painted fiberglass building components. The Facility buildings were demolished in the early 1980's.

In 1939, the Facility was connected to an industrial sewer system, and any discharge of plating wastewater directly onto the property ceased. The industrial sewer was connected to the plant by a sewer tributary. From 1939 to 1949, the industrial sewer tributary directed process wastewater from the Facility to wastewater treatment lagoons located northwest of the Facility. The lagoons are owned and operated by the City of Bronson. These lagoons are part of the associated North Bronson Industrial Area (NBIA) Superfund Site. By 1949, the western lagoons had reached capacity and the wastewater

generated by the L.A. Darling facility was directed to the lagoons located northeast of the Facility, also owned and operated by the City of Bronson. Disposal to the eastern lagoons via the industrial sewer was terminated when Facility operations ceased in 1967. The storm water and industrial sewer pipelines are in a utility corridor that runs in an east-west direction and bisects the Facility.

In 2007 the L.A. Darling Company requested permission from U.S. EPA to conduct soil excavation work in a portion of the Facility. This work was conducted during the fall and winter of 2007/2008. The City of Bronson has since reconstructed Railroad Street through a section of the Facility, in order to reduce truck traffic on a residential street. The cost of the road construction was reimbursed by the L.A. Darling Company. The L.A. Darling Company proposed cleanup standards, offered to pay for U.S. EPA oversight of the work, and stated its understanding that the work was done "at risk," meaning that U.S. EPA could require additional action in the work areas if the ROD so required. Approximately 5,100 cubic yards (cy) of contaminated soil and sludge were excavated from the site. In areas where sludge was found, excavations extended below the water table.

## **2.2 Enforcement Activities**

The primary PRP for NBFF OU2 is the L.A. Darling Company, a past owner/operator of the Facility. The L.A. Darling Company prepared the streamlined RI and FS reports under U.S. EPA oversight and with significant input from the MDEQ. The streamlined RI/FS focused on contamination within the property boundary. The streamlined RI/FS work was performed pursuant to an Administrative Order by Consent (AOC), Docket No. V-W-02-C-699, effective June 5, 2002, between the L.A. Darling Company and the U.S. EPA.

The current RI/FS AOC requires the evaluation of the nature and extent of contamination, which includes groundwater contamination that has moved beyond the property. As this ROD only selects an interim action for groundwater, an obligation remains under the AOC for the L.A. Darling Company to perform additional work as requested by U.S. EPA to define the extent of contamination beyond the property boundary and to evaluate cleanup alternatives to address the migration of contaminated groundwater.

## **3.0 PUBLIC PARTICIPATION**

The City of Bronson is the current owner of the former L.A. Darling facility. The City has expressed its interest in the ultimate development of the property. U.S. EPA coordinated with the City and the L.A. Darling Company on the implementation of the voluntary soil excavation work to allow for the accelerated restoration of Railroad Street through the property.

U.S. EPA has provided opportunity for public participation and comment in the process leading up to this ROD. The RI/FS Report and Proposed Plan for the former L.A. Darling facility were made available to the public in July of 2008. They can be found in the Administrative Record file, copies of which are available at the information repository maintained at the U.S. EPA Docket Room in Chicago, Illinois and at the Branch Library in Bronson. A notice was placed in the Coldwater Daily Reporter on July 16, 2008, regarding the availability of the RI and FS Reports and U.S. EPA's proposed cleanup plan for the Facility. Approximately 300 copies of the Proposed Plan Fact Sheet were distributed to the community and interested parties. A public meeting was held on August 7, 2008 to present the Proposed Plan to the community. At this meeting, representatives from U.S. EPA and the MDEQ discussed and answered questions about the site and the remedial alternatives. A public comment period was held from July 17, 2008 until August 15, 2008. U.S. EPA's response to comments received during the comment period is included in the Responsiveness Summary, which is part of this Record of Decision.

#### **4.0 SCOPE AND ROLE OF RESPONSE ACTION**

This is the second ROD for the NBFF Site. A ROD was issued on September 26, 2006 for the former Bronson Reel facility (NBFF OU1) to address the potential for contamination under Bronson Reel site buildings. The selected remedy required the establishment of a restrictive covenant on the property deed to address the possibility that contaminated soil might be present under the site buildings and to establish requirements for investigation and remediation should unacceptable levels of contamination be found in soil that is exposed as a result of the removal the building foundations. The former Bronson Reel facility is not considered to be a current source of contamination to groundwater.

This is the first ROD for the former L.A. Darling facility (NBFF OU2). U.S. EPA anticipates that this will be the final ROD for contaminated soils at the property. However, the remedy decision for the groundwater at the former L.A. Darling facility is considered to be an interim decision because additional actions will be necessary to address areas where contaminated groundwater plumes overlap. As such, the groundwater decision for the former L.A. Darling facility is focused on reducing contaminant mass at the Facility, controlling contaminant movement from the property, and ensuring that sufficient administrative controls are in place to ensure public safety in the short term until a final remedial action can be selected for NBFF groundwater.

In parallel with the work on the former L.A. Darling facility, the evaluation of the former Scott Fetzer facility (NBFF OU3) is also moving forward. A ROD for NBFF OU3 is anticipated in 2009.

#### **5.0 PEER REVIEW**

To ensure the credibility of the scientific work conducted during the RI/FS process, U.S. EPA utilized both forms of peer involvement: peer input and peer review. Peer input was conducted through internal Agency reviews, reviews by U.S. EPA's oversight contractor and reviews by MDEQ staff. An opportunity for peer review was provided during public comment. External comments were evaluated to determine whether any identified errors or disagreements were significant or warranted a modification of U.S. EPA's recommended alternatives based on a re-evaluation of the nine criteria.

#### **6.0 SITE CHARACTERISTICS**

Bronson is a rural community supported by a small industrial base and highway traffic. The population of Bronson is approximately 2,408. There are approximately 300 farms in the Bronson area. The agriculture of the area includes dairy production, swine, beef, sheep, and grain farming. In addition, several large farms specialize in the growing of Gladioli and other flowers on a commercial basis.

The majority of the residences in the vicinity of the Facility are connected to the City of Bronson water supply. The City of Bronson obtains its water from three wells side-gradient and upgradient of the Facility. Two of the primary wells are located approximately 4,000 to 5,000 ft east of the Facility and are screened in the upper aquifer. The third well is located approximately 1,000 ft southwest of the Facility and is screened in the lower aquifer. To ensure that those residents not served by the City water supply (such as Township residents north of the City and west of Albers Street/Burr Oak Road) are not impacted by groundwater contamination from the NBFF and NBIA sites, the State of Michigan periodically samples drinking water from homes utilizing private wells.

The former L.A. Darling facility consists of the real property Lots 45 through 48, as recorded in the Branch County Register of Deeds. The on-site buildings have been demolished, and a water tower (the

primary Facility feature, located in the northeast corner of the Facility) and water meter board are the only aboveground Facility features still present. The Facility is primarily covered by concrete slabs, representing former building floors, and is vegetated with grasses and weeds. Some slabs in the northern half of the Facility have subfloors. The concrete on the northern half of the Facility is in poor condition. The concrete on the southern half of the Facility is in generally fair condition. However, some of the concrete in the southern portion of the property was removed during the voluntary excavation work performed by the L.A. Darling Company during the fall and winter of 2007/2008. See Figure 3 for a map showing areas where excavation work has already been completed.

Since the completion of the voluntary excavation work conducted by the L.A. Darling Company, work to extend Railroad Street through the property (east-west) has been completed. This road extension will improve truck traffic flow through the area, and reduce truck traffic on residential streets. See Figure 3 for the location of the new road. Prior to the voluntary excavation work, a six-foot chain link fence surrounded the site. Since the construction of the road, the Facility fence has been realigned to restrict access to the northern portion of the property where soils exceeding Michigan Part 201 industrial/commercial direct contact criteria still remain.

Two underground storage tanks (USTs) are located just inside the northern Facility boundary. Based on the observed diameter and length of each tank, the capacity of each UST appears to be less than 2,000 gallons. One UST contains liquid, and the other is empty.

County Drain #30 (CD #30) is an enhanced natural canal located approximately 1,035 feet (ft) north of the Facility (see Figure 1). The drain originates at a marsh 0.5 miles northeast of the Facility, flows westerly, and discharges to Swan Creek at a point 1.5 miles northwest of the Facility. Swan Creek flows to the St. Joseph River, which discharges into Lake Michigan, three counties west of the Facility.

## **6.1 Geology**

Investigations at the Facility have found that the geology across the property is composed of glacial outwash deposits that range from well-sorted sands and silts to well-sorted and poorly-sorted gravels, as well as clays and silty clays. The depth to bedrock at the property is estimated to be approximately 150 ft below ground surface (bgs). The deepest soil boring drilled on the property has verified glacial material to a depth of 60 ft bgs. The general geologic profile of the property is outlined as follows:

- Sand with silt and clay from the ground surface to a depth ranging from approximately 4 to 11.5 feet bgs.
- Gravel, sand, and sand with gravel underlying the silt/clay/sand material, to a depth ranging from approximately 56 to 57 feet bgs.
- Silty clay with sands and fine gravel underlying the sand/gravel material (a glacial till unit).

## **6.2 Hydrogeology**

The former L.A. Darling facility is located in the St. Joseph Watershed. There are no surface water features on the property; however, local hydrogeology is influenced by CD #30. CD #30 is an enhanced natural drainage canal that is north of the property and flows to the west. CD #30 receives discharges from Bronson Plating, the Bronson Wastewater Treatment Plant, the storm sewer, and various farm fields

located north of the drain. Early NBIA investigations indicated that shallow groundwater flow discharged to CD #30. More recent investigations indicate that, occasionally, the groundwater system may be recharged by surface water from CD #30. CD #30 discharges to Swan Creek, which is a tributary of the St. Joseph River.

Groundwater flow at the site is generally to the northwest when water levels are higher and the surficial groundwater is discharging to CD #30. The high water levels combined with a local discharge point lead to steeper groundwater gradients and, hence, higher groundwater flow velocities when flow is northwesterly. When water levels fall, groundwater flow may have a greater westerly component. Groundwater in the surficial sand and gravel aquifer occurs under unconfined (water-table) conditions. The water table is relatively shallow and is generally found between 8 to 10 feet bgs.

### **6.3 Ecological Habitat**

The former L.A. Darling facility offers limited and low quality terrestrial habitat. The property has been used for industrial purposes for nearly a hundred years, and therefore the natural vegetative cover has long been disturbed. It is anticipated that the property will return to industrial use after remedial actions are complete.

More than two-thirds of the former L.A. Darling facility is currently covered with asphalt or concrete slabs. Field inspections indicate that there are no surface water bodies on-site. The Michigan Department of Natural Resources Wildlife division conducted a search of the Michigan Natural Features Inventory database. The results of the search indicated that there are no known occurrences of federal- or state-listed endangered, threatened, or otherwise significant species, natural plant communities, or natural features at the Facility.

### **6.4 Summary of Sampling Results / Extent of Contamination**

To evaluate the extent of contamination and estimate the risks to human health and the environment, samples were taken from site soils, groundwater, accumulated sediment from sewer pipes and manholes, and the two USTs located on the property. Samples were analyzed for a focused list of metals and VOCs. This list was developed based on previous investigations by the MDEQ. During the streamlined RI, soil and groundwater samples from the Facility were analyzed for:

Chloroethane	Arsenic
1,1-Dichloroethene (1,1-DCE)	Barium
1,1-Dichloroethane (1,1-DCA)	Cadmium
1,2-Dichloroethane (1,2-DCA)	Chromium (total)
cis-1,2-Dichloroethene (cis-1,2-DCE)	Chromium (hexavalent)
trans-1,2-Dichloroethene (trans-1,2-DCE)	Copper
Tetrachloroethene (PCE)	Lead
1,1,2,2-Tetrachloroethane (1,1,2,2-PCA)	Mercury
1,1,1-Trichloroethane (1,1,1-TCA)	Selenium
1,1,2-Trichloroethane (1,1,2-TCA)	Silver
Trichloroethene (TCE)	Zinc
Vinyl Chloride	Cyanide

Analysis of UST contents revealed multiple benzene, toluene, ethylbenzene, and xylene (BTEX) compounds, which will be removed when the USTs are removed. However, petroleum products are not regulated under CERCLA.

Table 1 in Appendix A to this ROD identifies contaminants found at the site and notes the frequency of detection and the range of detected concentrations. As part of the RI, analytical results were compared to Michigan Part 201 criteria to provide a relative assessment of soil contamination. This section provides a general discussion of the extent of contamination.

#### **6.4.1 Distribution of Soil Contamination**

The analytical data for soil samples collected during the Streamlined RI activities are presented in Tables 4-2 through 4-4 of the RI Report. To give a general indication of the extent of contamination, VOC and metal concentrations in soils by depth are graphically presented in Figures 4 - 6. In summary, the investigation found that multiple areas of the site contain inorganic contamination at levels exceeding MDEQ Part 201 industrial direct contact criteria. Many areas of VOC contamination exceed the MDEQ Part 201 criteria that address soil volatilization to indoor air. VOC levels in soil also exceed MDEQ Part 201 criteria for the protection of groundwater, indicating that VOC contamination is likely a continuing source of contamination to groundwater. Primary areas of soil contamination are, as follows:

- TCE contamination as high as 380,000 micrograms per kilogram (ug/kg) was found in shallow soils in the northeast portion of the Facility (Lot 45) in the area of the former chemical storage area.
- High levels of TCE (up to 97,000 ug/kg) were also found in shallow soils in the southeastern portion of the property (Lot 47) in the vicinity of the former TCE degreaser. Note that this area is within the zone addressed by the 2007/2008 voluntary action conducted by the L.A. Darling Company.
- Shallow (depth interval 0 to 2 feet bgs) arsenic contamination was found in the northeastern-most corner of the Facility in Lot 45. Concentrations were seen as high as 120,000 ug/kg.
- A lead hot spot, with concentrations up to 640,000 ug/kg, was found in Lot 46 in the central area of the property.
- Sludge containing high concentrations of arsenic, cadmium, lead, copper, and cyanide was found at the depth interval of 6 to 10 feet bgs in Lot 47 in the vicinity of the former plating strip tank. Lead concentrations in the sludge were found to be as high as 13,000,000 ug/kg. Note that the sludge area was fully excavated as part of the 2007/2008 voluntary early action conducted by the L.A. Darling Company.

#### **6.4.2 Distribution of Groundwater Contamination**

Groundwater at the former L.A. Darling facility is heavily contaminated with VOCs. VOCs were detected in on-site monitoring wells at concentrations far exceeding drinking water criteria. Analytical results from vertical aquifer sampling (VAS) indicated significantly higher levels of contamination than from the sampling of on-site groundwater monitoring wells. The primary contaminants of concern (COCs) in groundwater are TCE, cis-1,2-DCE, trans-1,2-DCE, PCE, 1,1,1-TCA, 1,1,2-TCE, and vinyl

chloride. A summary of VOC contaminant concentrations found in Facility groundwater is presented in Tables 3-2 and 4-6 of the RI Report. In general, the RI found:

- TCE in groundwater samples collected from the shallow screen depth ranged from 1,100 to 5,600 ug/L on the east half of the Facility. TCE in groundwater samples collected from the shallow screen depth ranged from non-detect to 610 ug/L on the west side of the Facility. TCE in groundwater samples collected from the intermediate screen depth ranged from 47 to 820 ug/L on the east half of the Facility, and from 400 to 3,200 ug/L on the west side of the Facility. TCE was not detected in groundwater samples collected from the deep screen depth on the east half of the Facility, and ranged from non-detect to 63 ug/L on the west side of the Facility.
- The degradation products of TCE are more prevalent and occur with greater frequency in the samples collected from intermediate wells than in shallow wells, and are more prevalent and occur with greater frequency in the samples collected from the shallow wells than the deep wells. Only one degradation product, cis-1,2,-DCE, was detected at the deep screen depth. The primary degradation product of TCE in the Facility groundwater is cis-1,2-DCE. The concentrations of cis-1,2-DCE are generally greater on the east half of the Facility than on the west at the shallow screen depth.
- TCE in VAS samples collected from the shallow screen depth ranged 17 ug/L to 43,000 ug/L on the east half of the Facility. TCE in VAS samples collected from the shallow screen depth ranged from non-detect to 24,000 ug/L on the west side of the Facility. TCE in VAS samples collected from the intermediate screen depth ranged from 1.5 ug/L to 2,600 ug/L on the east side of the Facility, and from 99 ug/L to 15,000 ug/L on the west side of the Facility. TCE in VAS samples collected from the deep screen depth ranged from non-detect to 27 ug/L on the east half of the Facility, and from 30 ug/L to 52 ug/L on the west half of the Facility.

Metals and cyanide are also present in Facility groundwater above drinking water criteria. However, the degree of metal and cyanide contamination is significantly less than what is seen for VOCs. The primary inorganic COCs are cadmium, chromium, lead, and cyanide, which are present at the site at concentrations above industrial drinking water criteria. In addition, copper, cyanide, silver, cadmium and selenium are present in groundwater at concentrations above the Michigan Part 201 Groundwater / Surface Water Interface (GSI) Criteria. However, although there are exceedances of inorganic GSI values within the Facility, the actual point of compliance for any GSI criterion is at a point close to the interface between the groundwater and the receiving surface water. A summary of metal and cyanide concentrations found in Facility groundwater is presented in Tables 3-3 and 4-7 of the RI Report.

#### **6.4.3 Sediment Contamination in Facility Sewers**

Sediment from broken storm and industrial sewers was collected and analyzed during the site investigation. The results showed elevated metals and VOCs, with TCE concentrations as high as 11,000 ug/kg. For purposes of the cleanup, accumulated material within storm and industrial sewers will be treated as soil. Abandoned sewer pipelines and manholes can be seen in Figure 7. Sewer sediment contaminant data can be found in Table 4-9 of the RI Report and in the NBIA Technical Memorandum, Operable Unit #2 (Industrial Sewer) Phase 2 Investigation by the MDEQ dated December 1999.

#### **6.4.4 Contamination in USTs**

A sample was collected from the liquid contained in the UST located outside of the northern edge of the property fence, within the boundary of the Facility. The sample was analyzed for VOCs and BTEX compounds. Analysis of the sample indicates that the UST contains a variety of VOCs and BTEX compounds at elevated concentrations. (Note that regulation of BTEX compounds does not fall under the purview of CERCLA. Nevertheless, the BTEX will be removed at the time the UST is removed.) The data is presented in Table 4-10 of the RI Report. The second UST present on the Facility was dry.

#### **6.5 Contaminant Fate and Transport**

Cadmium, chromium, copper, cyanide and zinc containing materials were used at the Facility during plating operations. Trace levels of arsenic and lead were found in slag and cinders associated with foundry and historical coal fired boilers that existed at the Facility. TCE was used for degreasing and cleaning equipment.

The evaluation of the concentration and extent of chemical constituents indicates that the presence of Facility-related VOC and inorganic contamination is primarily located in three source areas that correspond with former Facility operation workstations or production locations. The three source areas are:

- The former chemical storage area and northeast corner of Lot 45;
- The lead hotspot in grid H4 between the original store fixture and foundry buildings in Lot 46; and
- The former TCE degreaser and former plating strip tank area in Lot 47 (also referred to as the lagoon).

TCE at the Facility appears to be undergoing limited natural attenuation and degradation processes, as evidenced by the presence of cis-1,2-DCE trans-1,2-DCE, and vinyl chloride. The VOCs in the vadose zone could partition into air and migrate upwards from the soil directly to the atmosphere, or from the soil through cracks in the on-site concrete and into the ambient air. The volatilized VOCs can also migrate laterally through the vadose zone. VOCs dissolved in the groundwater will migrate along the natural hydraulic gradient with groundwater flow. TCE in Facility groundwater is generally moving from the shallow depths near the water table and vadose zone source areas west-northwestward across the Facility to greater depths. Along the western Facility boundary, TCE is present at the intermediate screen depths at greater concentrations than at the shallow and deep screen depths. Metals and cyanide at the Facility have most likely neither markedly changed chemically or physically since originally released. Elevated metals and cyanide in groundwater indicate that some leaching of metals and cyanide may be occurring.

#### **6.6 RI Conclusions**

To better understand site contamination, a chart showing the frequency of VOC and metal detections in soil and groundwater samples is provided as Table 1 in Appendix A to this ROD. To summarize the data collected and evaluated at the former L.A. Darling facility, the RI Report developed the following conclusions. These conclusions (along with summary conclusions associated with the human health risk assessment) were used to develop the FS alternatives and in the determination of U.S. EPA's recommended and selected alternatives.

- Metals and cyanide contamination in unsaturated soil at the Facility exceeds Michigan Part 201 industrial/commercial direct contact criteria.
- TCE in site soil exceeds MDEQ Part 201 criteria for the protection of drinking water, indicating that TCE in soil constitutes a continuing source of contamination to groundwater.
- The primary contaminants of concern within the unsaturated soils are 1,1-DCE, cis-1, 2-DCE, TCE, arsenic, cadmium, copper, lead, vinyl chloride and cyanide.
- Contaminated soil in Lot 45 is primarily characterized by elevated concentrations of TCE, which exceed drinking water protection criteria, GSI protection criteria, and indoor air inhalation criteria at depths 0 to 6 feet bgs. The source area is also characterized by three sample locations that exceed arsenic and lead direct contact criteria at 0 to 2 feet bgs. The contamination is in the general location of the former chemical storage area extending to the northeast corner of the Facility. The source area is covered by either vegetation or concrete.
- Contaminated soil in Lot 46 is primarily characterized by one sample location (sample SB-55) containing an exceedance of lead direct contact criteria at 0 to 2 feet bgs. Sample location SB-55 is located between the original store fixture building and the former foundry buildings. The hotspot is covered by concrete.
- Contaminated soil in Lot 47 is primarily characterized by elevated levels of TCE and vinyl chloride at concentrations exceeding drinking water protection criteria, GSI protection criteria, and indoor air criteria at 2 feet to 10 feet bgs. In addition, concentrations of metals at 6 to 9 feet bgs exceeded direct contact and particulate inhalation criteria. Colored layers of hardened sludge were found to be present at 6 to 10 feet bgs. The contamination is in the general location of the former TCE degreaser and plating strip tank. The source area is covered by 2 feet of vegetated soil. (Note that soil contamination in Lot 47 was removed during the excavation work of the L.A. Darling voluntary early action.)
- More than 6 inches of concrete overlay metal shavings in the southwest corner of the property. Soil samples taken in close proximity to the metal shavings do not indicate any exceedances of Part 201 direct contact criteria, indicating that the metal shavings are not likely a source of contamination.
- Sediment in the storm sewer pipe is characterized by contamination with metals and TCE.
- Sediment in the industrial sewer and associated manholes contains elevated levels of metals. Sediment in the industrial sewer manholes also contained low concentrations of TCE.
- One of the two 2,000-gallon capacity USTs contains liquid with VOCs. The second UST is dry.
- The primary contaminants of concern for Facility groundwater include 1,1-DCE, cis-1,2-DCE, TCE, PCE, vinyl chloride, antimony, arsenic, cadmium, copper, chromium, cyanide, iron, lead, manganese, nickel, selenium and silver.

## **7.0 CURRENT AND POTENTIAL FUTURE LAND AND WATER USES**

The former L.A. Darling facility is bounded on three sides by industrial/commercial properties. To the south is D&L Tooling. To the west is the former Scott Fetzer facility, NBFF OU3. To the north are railroad tracks and additional industrial businesses. While residential properties lie to the east of the Facility, it is anticipated that with nearly a hundred years of industrial activity at the site, the property will continue to be used for industrial and/or commercial use. The property is currently zoned for industrial use.

While most residents within the City of Bronson rely on City wells for their water, some private water supply wells remain in use in the northern portion of Bronson. In addition, township residents, to the north of CD #30 and to the west of Albers Street/Burr Oak Road rely on private wells. Groundwater in the northern industrial area of Bronson has been impacted by decades of manufacturing and there is area-wide groundwater contamination, with TCE, vinyl chloride and cis-1,2-DCE being the primary contaminants of concern. The Branch-Hillsdale-St. Joseph Community Health Agency, under contract with the MDEQ Water Bureau, conducts monitoring of private wells in the area to ensure that well users are not being exposed to contamination. This ROD does not address the area-wide groundwater contamination in the northern portion of the City of Bronson. In the future U.S. EPA will issue a final ROD to address the broader NBFF groundwater contamination. This future ROD may also address areas where NBIA contaminant plumes overlap with NBFF groundwater contamination.

## **8.0 SUMMARY OF SITE RISKS**

### **8.1 Human Health Risk Assessment**

The site-specific Human Health Risk Assessment (HHRA) evaluated both cancer risks and non-cancer health hazards from exposure to VOCs, metals and cyanide at the former L.A. Darling facility. This discussion emphasizes cancer risks and non-cancer health hazards that exceed U.S. EPA's goals for protection, which are a one-in-one million excess cancer risk and a non-cancer hazard index (HI) of 1. U.S. EPA and MDEQ note that the HHRA prepared for the former L.A. Darling facility was streamlined and did not fully comply with all U.S. EPA and MDEQ risk assessment guidance.

Because the remedy decision for Facility groundwater is considered an interim response, the HHRA focuses primarily on risks associated with exposures to Facility soils. U.S. EPA, the MDEQ and the L.A. Darling Company recognize that the significant level of groundwater contamination at and from the Facility clearly constitutes a risk in excess of  $1 \times 10^{-4}$  when the potential for groundwater consumption is considered. A detailed risk assessment for groundwater exposure pathways will be presented when a final decision for site-wide groundwater is issued.

Consistent with Superfund policy and guidance, a HHRA is a baseline risk assessment and therefore assumes no actions (remediations) to control or mitigate hazardous substance releases and no institutional controls, which are intended to control exposure to hazardous substances. Cancer risks and non-cancer hazard indices were calculated based on an estimate of the reasonable maximum exposure (RME) expected to occur under current and future conditions at the site. The RME is defined as the highest exposure that is reasonably expected to occur at a site. U.S. EPA also estimated cancer risks and non-cancer hazard indices based on central tendency (CT), or average, exposures at the site. The following discussion summarizes the HHRA with respect to the basic steps of the Superfund HHRA process: 1) Data Collection and Analysis, 2) Exposure Assessment, 3) Toxicity Assessment and 4) Risk Assessment.

### **8.1.1 Data Collection and Analysis**

The HHRA prepared as part of the RI was conducted using validated analytical results from samples of soil and groundwater. Soil and groundwater contaminant concentrations were used to derive estimates of indoor and outdoor air concentrations for site chemicals. In this assessment, because of cross-media analysis and the focused list of parameters used during the RI, no screening for chemicals of potential concern (CoPCs) was conducted. Instead, all detected chemicals were included in risk calculations. The data were grouped as follows:

- Surface soil data (defined as the first soil interval, which in this dataset were data from 0 to 2 feet below ground surface) were used in direct contact scenarios for the industrial worker and to derive the air concentrations for particulate risk estimates.
- All soil data combined were used to derive risk estimates for the construction worker exposure pathways for direct contact with soil (incidental ingestion and dermal contact) and to generate outdoor air concentrations of volatiles for both industrial and construction workers. All soil data combined were also used to estimate the volatile concentrations used for the indoor air pathways for industrial workers.
- Because an interim action is being put forward to address Facility groundwater, the evaluation of the groundwater risk pathways was limited. All on-site groundwater data were combined to derive exposure estimates for volatiles in indoor air for industrial workers. The groundwater contact and consumption pathway was not evaluated as part of the HHRA, but will be fully addressed in the final ROD for NBFF groundwater.

Data were compiled as stated above and U.S. EPA ProUCL Version 3 was used to estimate the upper confidence limit (UCL) of the mean concentration as is recommended in U.S. EPA guidance.

Undetected data were included in the risk calculations at ½ of the detection limit. The ProUCL software first provides an assessment of statistical distribution of the data and indicates whether the data best fit a normal or lognormal distribution or if the data fit neither of these distribution types. Then the ProUCL software calculates UCLs from various types of distributions through application of a range of U.S. EPA identified methods and selects the method thought to best represent the upper confidence limit of the mean concentration. The UCL identified by the software as the best fit was used in the subsequent risk estimates. In all cases, the selected UCL represented at least a 95% UCL on the mean. In many cases the UCL selected by the model and applied in the HHRA was greater than the 95<sup>th</sup> percentile, i.e., many 97<sup>th</sup> percentile values were used.

### **8.1.2 Exposure Assessment**

The former L.A. Darling facility has been the site of industrial activity for nearly a hundred years. The property is currently used for industrial purposes, and such uses are expected to continue in the future. Thus, no residential exposure scenarios were considered in the HHRA. Risks for groundwater use scenarios were not quantified, and instead will be addressed during the selection of the final action for NBFF groundwater.

Given the nature of the Facility and the anticipated future uses, workers who might come into contact with site media were considered to be the most likely site receptors. Two worker scenarios were considered: 1) an industrial worker (using assumptions identified by MDEQ, including assumed exposure

to site contaminants over a 25-year period); and 2) a construction worker, who is exposed only for a year, but has a higher level of exposure to subsurface soil during excavation activities.

The following media and associated exposure pathways were included in quantitative risk calculations:

- Surface soils – exposure pathways included incidental ingestion of and dermal contact with soil by an industrial worker. Data for surface soils were also used to generate risk estimates for exposure to particulates in outdoor air for an industrial worker and a construction worker.
- Shallow and deep soils combined – exposure pathways evaluated included incidental ingestion and dermal contact with soil by a construction worker.
- Volatile chemicals in air – exposure pathways evaluated included volatile chemicals that could hypothetically be generated from all soils or from all groundwater, including the following pathways:
  - Inhalation of vapors indoors by an industrial worker based on air concentration estimates derived from all soil concentrations.
  - Inhalation of vapors outdoors by both an industrial worker and a construction worker based on air concentration estimates derived from all soil concentrations.
  - Inhalation of vapors indoors by an industrial worker based on air concentration estimates based on estimates derived from groundwater concentrations.

### 8.1.3 Exposure Quantification

Exposure assessment is the process of identifying human populations that could potentially contact site-related chemicals and estimating the magnitude, frequency, duration, and route(s) of potential exposures. In the former L.A. Darling facility HHRA, potential risks were evaluated in hypothetical future workplace scenarios for an industrial worker and a construction worker. Exposure assessment for all detected site chemicals were conducted by combining estimates of chemical concentrations in soil or air (as derived from groundwater or soil) (as the UCL) with the estimates of the degree of contact with those media to derive a long-term, chronic daily intake (CDI) estimate.

#### 8.1.3.1 Inhalation and Ingestion Pathways

In evaluation of the inhalation and ingestion pathways related to air and soil, the CDI or daily exposure to each chemical was estimated using the following general algorithm:

$$CDI (mg / kg - day) = \frac{C \times CF \times CR_m \times ED \times EF}{BW \times AT}$$

where:

- C = chemical concentration in soil (mg/kg) or air (mg/m<sup>3</sup>) (expressed as the UCL)
- CF = conversion factor as needed to correct units in soil or air
- CR<sub>m</sub> = contact rate for media – soil (mg/day), or air (m<sup>3</sup>/day)
- ED = exposure duration (years)
- EF = exposure frequency (days/year)
- BW = body weight (kg)

- AT = averaging time
- non-carcinogens – exposure duration x 365 days
  - carcinogens – 70 year lifetime x 365 days

The following specific exposure assumptions were applied in this assessment. These exposure terms are consistent with MDEQ cleanup criteria except as indicated.

### Exposure Assumptions Applied in HHRA for Inhalation and Ingestion Pathways

Exposure Parameter	Units	Industrial Worker	Construction Worker
Exposure frequency (EF)	days/year	245	250 <sup>a</sup>
Exposure duration (ED)	years	21	1 <sup>a</sup>
Contact rate for soil (ingestion rate) (CR <sub>m</sub> )	mg/kg	100	330 <sup>a</sup>
Contact rate for air (inhalation rate) (CR <sub>m</sub> )	m <sup>3</sup> /day (workday)	10	10
Body weight	Kg	70	70
Averaging time – Noncarcinogens	days	7665	365
Averaging time – Carcinogens	days	25550	25550

\* <http://epa-ssl.ornl.gov/equations.shtml> From U.S. EPA Soil Screening Guidance for construction worker.

#### 8.1.3.2 Dermal Pathway

For the dermal contact with soil exposure pathway, the following algorithm was applied:

$$CDI (mg/kg - day) = \frac{C \times CF \times CR_m \times ED \times EF \times ABS \times AF \times SA}{BW \times AT}$$

where:

- C = chemical concentration in soil (mg/kg) or air (mg/m<sup>3</sup>) (expressed as the UCL)
- CF = conversion factor as needed to correct units in soil
- CR<sub>m</sub> = contact rate for media – soil (mg/day)
- ED = exposure duration (years)
- EF = exposure frequency (days/year)
- ABS = absorption rate from the skin (unitless) – chemical-specific
- AF = adherence factor (mg/cm<sup>3</sup>)
- SA = surface area of skin contacting soil (cm<sup>2</sup>)
- BW = body weight (kg)
- AT = averaging time
  - non-carcinogens – exposure duration x 365 days
  - carcinogens – 70 year lifetime x 365 days

The following specific exposure assumptions were applied for the dermal assessment. Assumptions not identified here are the same as those for the ingestion and inhalation pathways. These exposure terms are all taken from MDEQ cleanup criteria except as indicated.

## Exposure Assumptions Applied in HHRA for Dermal Contact with Soil Pathways

Exposure Parameter	Units	Industrial Worker	Construction Worker
Exposure frequency (EF)	days/year	160	250
Adherence factor (AF)	unitless	0.2	0.3 <sup>a</sup>
Surface area (SA)	cm <sup>2</sup>	3300	3300

\* <http://epa-ssl.ornl.gov/equations.shtml> From U.S. EPA Soil Screening Guidance for construction worker.

As described previously, modeling was conducted through application of soil and groundwater concentrations to estimate indoor and outdoor air concentrations. The particulate concentrations were derived through application of a particulate emissions factor to the UCL for surface soil (for more information, see Appendix G-3 of the HHRA). Indoor air concentrations of volatile chemicals were modeled through application of the Johnson and Ettinger model. Concentrations of volatile chemicals in outdoor air were calculated using chemical-specific volatilization factors to estimate migration from soil to outdoor air using methods indicated by MDEQ.

### 8.1.4 Toxicity

The purpose of a toxicity assessment is to evaluate the potential for chemicals to cause adverse health effects in exposed persons and to thoroughly define the relationship between the extent of exposure to a hazardous chemical and the likelihood and severity of any adverse health effects. The standard procedure for a toxicity assessment is to identify toxicity values for carcinogenic and noncarcinogenic effects and to summarize other relevant toxicity information. Toxicity values used in risk assessment of oral exposures are termed cancer slope factors (CSFs) and reference doses (RfDs). CSFs are used to estimate the incremental lifetime risk of developing cancer corresponding to CDIs calculated in the exposure assessment. The potential for noncarcinogenic health effects is evaluated by comparing estimated daily intakes to RfDs, which represent daily intakes at which no adverse effects are expected to occur over a lifetime of exposure. Both CSFs and RfDs are specific to the route of exposure (e.g., ingestion [oral] exposure). Currently, no CSFs or RfDs exist for dermal exposure; therefore, oral CSFs and RfDs were used to assess dermal exposure. For inhalation, unit risk factors for carcinogens and reference concentrations for noncarcinogens were applied. The toxicity values used in the HHRA are those listed in Table 4 of the MDEQ 214 regulations and are also generally consistent with the U.S. EPA Integrated Risk Information System (IRIS) values.

### 8.1.5 Risk and Hazard Estimates

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to a carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times CSF$$

where: risk = a unitless probability (e.g.,  $2 \times 10^{-5}$ ) of an individual developing cancer  
 CDI = chronic daily intake (mg/kg-day)  
 CSF = cancer slope factor, expressed as (mg/kg-day)<sup>-1</sup>.

These risks are probabilities that usually are expressed in scientific notation (e.g.,  $1 \times 10^{-6}$ ). An excess lifetime cancer risk of  $1 \times 10^{-6}$  indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an “excess lifetime cancer risk” because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual’s developing cancer from all other causes has been estimated to be as high as one in three. U.S. EPA’s generally acceptable risk range for site-related exposures is  $10^{-4}$  to  $10^{-6}$ .

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified period (e.g., a lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An  $HQ < 1$  indicates that a receptor’s dose of a single contaminant is less than the RfD, and that noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemicals of concern that affect the same target organ (e.g., the liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An  $HI < 1$  indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An  $HI > 1$  indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI} / \text{RfD}$$

where: CDI = Chronic daily intake  
RfD = reference dose

The CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

The HHRA evaluated current and potential future industrial exposure scenarios and calculated the carcinogenic risk and the HI for each. A full discussion of carcinogenic and non-carcinogenic risks for site-wide and area-specific scenarios is presented in the HHRA section of the RI. The results are summarized in the following tables. Note that the scenarios considered do not include a calculation of risk associated with groundwater use. More detailed tables summarizing the risk contribution of each contaminant can be found in Tables 2 and 3 in Appendix A to this ROD.

Estimates of Non-Carcinogenic Risk (excluding potential use of groundwater)			
Receptor	Exposure Pathway	Hazard Index	Hazard Driver
Industrial Worker	Indoor soil vapor inhalation, indoor groundwater vapor inhalation, outdoor soil vapor inhalation, outdoor fugitive dust inhalation, dermal contact and incidental soil ingestion	HI = 1.2	Indoor inhalation of mercury in soil vapor.
Construction Worker	Outdoor soil vapor inhalation, outdoor fugitive dust inhalation, dermal contact, and incidental soil ingestion	HI = 2.7	Incidental ingestion of arsenic, cadmium and copper in site soils.

Estimates of Carcinogenic Risk (excluding potential use of groundwater)			
Receptor	Exposure Pathway	Risk	Risk Driver
Industrial Worker	Indoor soil vapor inhalation, indoor groundwater vapor inhalation, outdoor soil vapor inhalation, outdoor fugitive dust inhalation, dermal contact, and incidental soil ingestion	$2 \times 10^{-5}$  <i>Note: The modeled vapor intrusion pathway may underestimate the risk of vapor intrusion. Recent soil gas and indoor air data from residents near the former L.A. Darling facility indicates that there is a potential for unsafe levels of VOCs in indoor air even if the Johnson &amp; Ettinger model shows minimal risk.</i>	Outdoor soil vapor inhalation of TCE, vinyl chloride and 1,1-DCE.  Incidental soil ingestion of arsenic-contaminated soil.
Construction Worker	Outdoor soil vapor inhalation, outdoor fugitive dust inhalation, dermal contact, and incidental soil ingestion	$2 \times 10^{-6}$	Incidental soil ingestion of arsenic-contaminated soil.

Groundwater is currently not in use at the Facility. However, groundwater remains in use in township areas to the north of CD #30 and in some residences within the City of Bronson. If, under a potential future use, groundwater were to be used as a source of drinking water either within the Facility or within impacted areas of the aquifer downgradient of the Facility, water users would be exposed to a significant increase in carcinogenic and noncarcinogenic risks. U.S. EPA's maximum contaminant level (MCL) for TCE is 5 ug/L. Groundwater at the former L.A. Darling facility has been found to contain TCE at levels as high as 43,000 ug/L and to contain high levels of other potential and known carcinogenic VOCs. Therefore, it is clear that any scenario assuming groundwater consumption would pose a risk in excess  $1 \times 10^{-4}$ , the upper bound of U.S. EPA's risk range.

## **8.2 Ecological Risk Assessment**

A screening level ecological risk assessment was completed for the former L.A. Darling facility. Maximum surface soil concentrations of two VOCs, ten metals and cyanide exceeded ecological screening levels. The screening level risk assessment also noted:

- The Facility is only approximately 2 acres in size, has been under use for almost 100 years, and is in a developed area. Two-thirds of the property is covered with concrete and potential exposure areas are limited to sparsely vegetated and disturbed areas totally approximately 0.6 acres.
- There are no known occurrences of special concern species or sensitive habitats at the property.
- The future anticipated use for the property is industrial/commercial. Under planned future use, buildings and pavement will likely cover most of the property.

The RI Report notes that the weight of evidence indicates that significant terrestrial habitat is absent from the property and will remain so under planned future use. The screening level risk assessment determined that there is adequate information to determine that ecological risks are negligible. While that may be so, the screening level ecological risk assessment often used assumptions more appropriate for a Michigan Remedial Action Plan proposal, where there is an assumption that tasks have been addressed as part of a remedial action. Therefore, what was evaluated in the RI Report more accurately represents residual risk after completion of site cleanup. To ensure ecological protectiveness, a follow-up ecological assessment should be completed during the remedial design of the soil remedy to ensure that ecological risks are being addressed.

## **9.0 REMEDIAL ACTION OBJECTIVES**

### **9.1 Remedial Action Objectives**

Soil at the former L.A. Darling facility is contaminated with VOCs, metals and cyanide. Groundwater is heavily contaminated with VOCs, but has also been impacted by Facility metals. Groundwater contamination extends off-site where the contaminant plume overlaps areas of contamination from other source areas. Current and potential future land uses of the former L.A. Darling facility include commercial and industrial development. Risks from potential groundwater use have not been quantified as part of the HHRA, but U.S. EPA, the MDEQ and the L.A. Darling Company acknowledge that risks from potential groundwater consumption would greatly exceed the allowable risk range. Actual and potential receptors include industrial workers employed on site, construction workers at the Facility, and trespassers on the facility property. The overall remedial action objectives for this ROD for the former L.A. Darling facility are:

- To restore contaminated soils in accordance with ARARs, specifically Michigan Part 201 Industrial and Commercial Direct Contact Criteria and Michigan Part 201 GSI Protection Criteria (for those contaminants that are a source or a potential source of GSI groundwater exceedances at CD #30), whichever is lower;
- To address site soils in a manner that allows for industrial/commercial property redevelopment; and
- To commence a groundwater action that will reduce VOC mass within the Facility, reduce levels of contamination moving off site, and ultimately provide for control of the contaminated groundwater within the Facility boundary.

## 9.2 Overview of ARARs

Under Section 121(d)(2)(a) of CERCLA, on-site remedial actions must attain a level or standard of control that achieves any standard, requirement, criterion, or limitation under any federal environmental law determined to be legally applicable or relevant and appropriate. CERCLA also requires remedial actions to achieve a level or standard of control that attains any promulgated standard, requirement, criterion, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criterion, or limitation and is legally applicable or relevant and appropriate.

### Chemical-Specific ARARs and TBCs

Chemical-specific ARARs include state and federal requirements that regulate contaminant levels in various media. In addition to ARARs, guidance materials that have not been promulgated or regulatory standards that are not applicable or relevant and appropriate may be considered (including local/county requirements); these are referred to as items “to be considered” (TBC). While TBCs may be considered along with ARARs, they do not have the status of ARARs. ARARs and TBCs are important in developing remedial objectives that comply with regulatory requirements or guidance (as appropriate). Summaries of potential chemical-specific ARARs for the soil and groundwater are presented in Table 4 in Appendix A to this ROD. These ARARs include the state and federal statutes specified below:

- The allowable cleanup levels in soil were derived from Michigan Part 201 and Part 31 of Michigan’s Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended. Michigan Part 201 of NREPA provides guidelines for developing cleanup levels for a variety of categories, including residential, commercial, and industrial properties. Sections 2012a and 2012b of Part 201 contain health-based soil standards for residential and industrial/commercial land use. Also, Michigan Part 201 provides land-use requirements and guidelines for developing remedial action plans for sites that do not meet residential cleanup goals as well as overall liability and responsibilities of the site owner and operator.
- The Michigan Safe Drinking Water Act (Act 399) provides state drinking water and monitoring standards protective of human health. While final cleanup standards are not being set at this time for Facility groundwater, these standards should be taken into consideration during the development of the interim action for groundwater.
- Part 31, Water Resources Protection, of the NREPA establishes rules regarding water and wastewater discharges. This is applicable for discharge of waters to CD #30.

- Under the federal Safe Drinking Water Act (SDWA), U.S. EPA has established primary drinking water standards as Maximum Contaminant Levels (MCLs) that are the maximum level of a specific contaminant, based on human health factors, allowed in water delivered to any user of a public water system. The MCL for each contaminant is established as close as possible to the MCL goal for that contaminant. Considering technology, treatment MCLs are promulgated in accordance with the federal SDWA. Michigan Act 399 adopts the federal MCLs as acceptable concentrations for public drinking water supplies. MCLs may not be appropriate when multiple contaminants or exposure pathways exist. Secondary MCLs, which generally address taste or odor considerations, are not enforceable and are considered TBCs by U.S. EPA. MCLs should be taken into consideration during the design of the interim groundwater action. However, groundwater cleanup standards will be established during the final ROD for NBFF groundwater.

### **Action-Specific ARARs**

Action-specific ARARs are regulatory requirements that define acceptable treatment and disposal procedures. Summaries of potential action-specific ARARs for the soil and groundwater are presented in Table 5 in Appendix A to this ROD. These ARARs were derived from the state and federal statutes discussed below, as well as the CWA and Michigan Act 245 described above.

- Part 115, Solid Waste Management, of the NREPA contains regulations regarding the construction, operation, and closure of sanitary landfills, solid waste transfer facilities, and solid waste processing plants. Part 115 of the NREPA also includes provisions for characterizing solid wastes.
- Part 111, Hazardous Waste Management, of the NREPA and its implementing regulations in R 299.9301 of the Michigan Administrative Code require generators of hazardous waste to properly identify, store, and dispose of hazardous waste. Contaminated soil at the former L.A. Darling facility may include hazardous wastes.
- Part 91, Soil Erosion and Sedimentation Control, of the NREPA provides measures to control soil erosion and sedimentation of state surface waters.
- Part 55, Air Pollution Control, of the NREPA provides measures to control air emissions of critical pollutants from various air contaminant source categories and processes that could affect human health and the environment. These standards would be critical for the design and operation of any treatment system that would potentially release contaminants into the air.
- The federal Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for some “criteria pollutants” expressed as primary and secondary allowable short- and long-term concentrations (expressed as micrograms per cubic meter in air). Under the CAA, various policies and procedures are outlined that pertain to air contaminant source review and are designed to preserve or ensure progress toward the attainment of the NAAQS. As with the Part 55 standards noted above, the federal CAA standards would be critical for the design and operation of any treatment system that would potentially release contaminants into the air.
- Emission limitations for new and existing sources of hazardous pollutants have been developed under the federal National Emission Standards for Hazardous Air Pollutants (NESHAP). NESHAPs are uniform national standards for existing, modified, and new sources of specific

toxic contaminants in air designed to ensure an adequate margin of safety for the public. Under the CAA amendments of 1990, Title III, 189 chemicals have been listed as toxic air pollutants to be regulated. U.S. EPA may add or delete chemicals from this list. NESHAPs standards would also need to be addressed during the design and operation of any treatment system that would potentially release contaminants into the air.

- Part 31, Water Resources Protection, of the NREPA regulates the direct and indirect discharge of any injurious substance to the waters of the state. The Water Resources Commission may develop water quality standards for preventing the pollution of the waters of the state. These standards are ARARs for the discharge of treated water from the Facility.
- Under the federal Water Pollution Control Amendment of 1972, commonly known as the Clean Water Act, the government strives to eliminate the discharge of pollutants from the nation's waterways. The development of local sewage treatment systems and the required treatment of industrial and municipal wastewater have assisted in addressing this goal. Under the CWA and its amendments, U.S. EPA has established federal guidelines for development of water quality criteria to protect human health and aquatic life from exposure to pollutants. These federal water quality criteria (FWQC) were developed as guidelines that states use to establish their water quality standards. Although the FWQC themselves have no direct regulatory impact, they are used to derive regulatory requirements that can include water quality-based effluent limitations, water quality standards, and toxic pollutant effluent standards. The use of the FWQC is based on the designated or potential use of the surface water body. FWQC are then translated into enforceable effluent limitations in a National Pollutant Discharge Elimination System (NPDES) point-source permit for direct discharge to surface water. Before any site can discharge to surface water, an NPDES permit is required under the CWA. The State of Michigan has been authorized to implement and enforce the NPDES permitting program. Authority for NPDES permit issuance rests with the Michigan Water Resources Commission. As with the Part 31 standards above, CWA standards are ARARs for the discharge of treated water from the Facility.
- Michigan Occupational Safety and Health Act 154 (MIOSHA): MIOSHA establishes the rules for safety standards in the work place and is applicable to the remediation activities.

### **Location-Specific ARARs**

Location-specific ARARs are requirements for contaminant concentrations or remedial activities resulting from a site's physical location. For example, federal and state ARARs exist for sites where remedial activities would impact wetlands, flood plains, critical habitats, wilderness areas, fault zones, or areas of historic or significant artifacts. Summaries of potential location-specific ARARs for the soil and groundwater are presented in Table 6 in Appendix A to this ROD.

## **10.0 DESCRIPTION OF ALTERNATIVES**

During the development of the FS, individual alternatives were developed to address two general focus areas: soil and groundwater. Soil alternatives address contaminated unsaturated soil (from the ground surface to the water table) and any potential source area materials such as sludge, sewer sediment, and contaminated UST liquids. Groundwater alternatives focus on removal of VOC mass from the saturated zone, with a goal to ultimately control the movement of contaminated groundwater beyond Facility boundaries.

## **10.1 Source Material Alternatives**

### **10.1.1 No Action Soil Alternative –**

Under the No Action Soil Alternative, soil conditions remain as they currently exist. No remedial actions would be taken to address contamination or restrict exposure to site soils.

The estimated present worth of this remediation alternative is \$0.

### **10.1.2 Soil Action Alternative 1 - Excavation and Off-site Disposal, Continued Industrial Land Use and Short-term Fencing - U.S. EPA's Selected Source Material Alternative**

This remedial action alternative provides for the removal of contaminated soil and contaminated source materials from the zone above the water table. Under this Remedial Action Alternative, the contaminated soils, source materials and structures representing an estimated 2,700 cubic yards would be excavated and transported to a secure landfill. There would be no destruction of the hazardous materials required, only relocation. However, the L.A. Darling Company has indicated that it plans to stabilize soils prior to disposal as was previously done with the voluntary cleanup work from 2007/2008. The regulatory soil cleanup criteria imposed would be the Michigan Part 201 Industrial Direct Contact Criteria and the Michigan Part 201 GSI Protection Criteria (for those contaminants that pose a risk of creating an exceedance of the GSI criteria in groundwater at CD #30). These cleanup criteria would allow for continued industrial use of the Facility and reduce concentrations of material that could leach to groundwater at concentrations ultimately exceeding the GSI criteria in nearby CD #30. Temporary fencing would be installed during the excavation and site restoration activities to protect the general public. Because this action would only address contamination in the vadose zone, a warranty deed restriction would be necessary to restrict activities below the water table and to ensure that any structures built at the property would be designed to address vapor intrusion from contaminated groundwater below the Facility.

The estimated present worth of this remediation alternative is \$623,566. This estimate is based on a Capital Cost of \$583,566 and five years of supplemental duty of care soil monitoring (at approximately \$5,000 per year) to ensure that all standards have been addressed.

### **10.1.3 Soil Action Alternative 2 – Chemical Oxidation, Continued Industrial Land Use, Short-term Fencing, Long-term Soil Cover and Deed Restriction**

This remedial action alternative uses chemical oxidation to treat metals in the soils at the Facility. A thorough mixing of the chemical oxidant would be required to assure a reduction of the toxicity of the contaminants. Chemical oxidation would be ineffective in treating any contaminated structures encountered, and the presence of structures could complicate thorough treatment of all contaminated materials. A soil cover would be constructed at the property to restrict contact with treated soil and to allow for limited property development. Fencing would be required during on-site remedial activities. A warranty deed restriction would be necessary to restrict activities at the Facility and to ensure that any structures built at the property would be designed to address vapor intrusion from contaminated groundwater below the Facility.

The estimated present worth of this remediation alternative is \$1,092,270. This cost is based on a Capital Cost of \$972,270 and ten years of supplemental duty of care soil monitoring and the maintenance of the restrictive soil cover (at approximately \$15,000 per year).

**10.1.4 Soil Action Alternative 3 – Soil Vapor Extraction, Continued Industrial Land Use, Short-term Fencing, Long-term Soil Cover, and Deed Restriction**

This remedial action alternative uses soil vapor extraction (SVE) to remove the VOC contamination in the unsaturated soils and requires destruction or adsorption of the recovered volatile compounds. This type of technology would be effective for the treatment of VOC contamination, but would be ineffective in the treatment of metal contamination. It is estimated that the SVE system would need to be operational for approximately 5 years. Fencing would be required during the on-site activities. A soil cover would be constructed to cover remaining soil contamination. Long-term fencing and monitoring would be required to protect the general public and to ensure the integrity of the soil cover. A warranty deed restriction would be necessary to restrict activities at the Facility and to ensure that any structures built at the property would be designed to address vapor intrusion from contaminated groundwater below the Facility.

The estimated present worth of this remediation alternative is \$808,680. This estimate is based on a Capital Cost of \$232,680 and five years of O&M of the SVE system (at approximately \$120,000 per year) and follow-up monitoring to ensure the integrity of the soil cover.

**10.2 Groundwater Interim Action Alternatives**

**10.2.1 *No Action Groundwater Alternative –***

**10.2.2 Groundwater Action Alternative 1 - Air Sparging with Soil Vapor Extraction, Groundwater Extraction, Continued Industrial Land Use, Groundwater Use Restriction Ordinance, Short-term Fencing and Monitoring – U.S. EPA's Selected Groundwater Interim Action**

This remedial action alternative uses air sparging, which is the introduction of air into the saturated zone to increase the volatilization of the VOCs that contaminate the groundwater at the Facility. The vapors would be recovered by soil vapor extraction utilizing a vacuum applied to the unsaturated zone soils. The recovered vapors would then be treated using appropriate technologies, such as granular activated carbon or thermal oxidation, and released to the atmosphere at a permitted rate. Once the recovery rate of the air sparging system drops to a level that U.S. EPA agrees warrants discontinuation of the sparging/SVE system, the treatment system would be converted to allow for groundwater extraction. With the groundwater extraction and treatment system, contaminated groundwater would be pumped from below the site to further reduce VOC mass and to hydraulically control the movement of contaminated groundwater from the site. Extracted groundwater would be treated with air stripping, granular activated carbon filtration, and chemical precipitation (or U.S. EPA approved equivalent treatment technology). Fencing would be required during remedial construction activities. During system operations, critical systems would need to be fenced, or otherwise secured, to ensure system integrity. Routine monitoring of the groundwater would be required during the entire time of groundwater treatment. Treated water would be discharged to CD #30. As this is an interim action to address localized groundwater contamination at and immediately near the former L.A. Darling facility, it should be noted that the goal of the groundwater remediation is to reduce VOC mass within the Facility boundary and ultimately control the movement of contaminated groundwater from the Facility. A warranty deed restriction would be required to prohibit use of groundwater at the Facility. The L.A. Darling Company may also pursue a groundwater use restriction ordinance with the City of Bronson as an interim measure to address groundwater contamination beyond the Facility boundaries.

The estimated present worth of this remediation alternative is \$1,371,000. This estimate is based on a Capital Cost of \$455,000 and 30 years of annual O&M costs of \$114,500.

**10.2.3 Groundwater Action Alternative 2 – Extraction and Off-Site Disposal, Granular Activated Carbon Treatment, Continued Industrial Land Use, Groundwater Use Restriction Ordinance and Short-term Fencing and Monitoring**

In this remedial action alternative the contaminated groundwater beneath the Facility would be extracted using groundwater recovery wells and treated on-site with granular activated carbon for the removal of the organics and chemical precipitation and oxidation for the metals and cyanide. Post filtration will be required for discharge to CD #30. Fencing would be required during remedial construction activities. During system operations, critical systems would need to be fenced, or otherwise secured, to ensure system integrity. Routine monitoring of the groundwater will be required during the remediation activities. As this alternative would be an interim action to address localized groundwater contamination at and immediately near the former L.A. Darling facility, it should be noted that the goal of the groundwater remediation is to reduce VOC mass within the Facility boundary and ultimately control the movement of contaminated groundwater from the Facility. A warranty deed restriction would be required to prohibit use of groundwater at the Facility. The L.A. Darling Company may also pursue a groundwater use restriction ordinance with the City of Bronson as an interim measure to address groundwater contamination beyond the Facility boundaries.

The estimated net present worth of this remediation alternative is \$2,053,000. This estimate is based on a Capital Cost of \$563,000 and 30 years of annual O&M costs of \$186,000.

**10.2.4 Groundwater Action Alternative 3 – Extraction and Off-Site Disposal, Chemical Oxidation Treatment, Continued Industrial Land Use, Groundwater Use Restriction Ordinance and Short-term Fencing and Monitoring**

This alternative is very similar to Groundwater Action Alternative 2, and differs only by the treatment method to be used on the extracted groundwater. In this remedial action alternative, the contaminated groundwater beneath the Facility would be extracted using groundwater recovery wells and treated on-site with oxygen and ozone to destroy the volatile organic contaminants. Post treatment with granular activated carbon for the removal of the refractory organics and chemical precipitation and oxidation for the metals and cyanide would be provided. Post filtration would be required for discharge to CD #30. Fencing would be required during remedial construction activities. During system operations, critical systems would need to be fenced, or otherwise secured, to ensure system integrity. Routine monitoring of the groundwater will be required during the remediation activities. As this alternative would be an interim action to address localized groundwater contamination at and immediately near the former L.A. Darling facility, it should be noted that the goal of the groundwater remediation is to reduce VOC mass within the Facility boundary and ultimately control the movement of contaminated groundwater from the Facility. A warranty deed restriction would be required to prohibit use of groundwater at the Facility. The L.A. Darling Company may also pursue a groundwater use restriction ordinance with the City of Bronson as an interim measure to address groundwater contamination beyond the Facility boundaries.

The estimated present worth of this remediation alternative is \$1,463,695. This estimate is based on a Capital Cost of \$687,695 and 30 years of annual O&M costs of \$97,000.

## **11.0 COMPARATIVE ANALYSIS OF ALTERNATIVES**

This section provides a brief comparison of the soil and groundwater alternatives considered. For additional information, please see the FS Report and supplemental information presented in the Administrative Record. Table 7, in Appendix A to this ROD, provides additional information on the comparison of alternatives.

### **11.1 Source Material Alternatives**

The four soil alternatives developed for the former L.A. Darling facility are compared below.

#### **11.1.1 Overall Protection of Human Health and the Environment**

The No Action Soil Alternative would not provide overall protection to human health and the environment under future land-use scenarios because risks posed by contaminants at the site would remain. Soil contamination would remain at levels above Part 201 industrial direct contact criteria. If the property were to be redeveloped for commercial or industrial use, workers could be exposed to levels of contamination above levels considered safe.

Under Soil Action Alternative 1, contaminated soil and source material would be removed from the property in the zone above the water table. Therefore, Soil Action Alternative 1 would provide for protection of human health by eliminating unsafe material from the zone of soils typically encountered by workers at a site. If implemented in conjunction with Groundwater Action Alternative 1, the VOC levels would be further reduced, minimizing future leaching of VOC contamination to groundwater. A warranty deed restriction would be used to limit any activity below the water table.

Soil Action Alternatives 2 and 3 provide for treatment of contamination on-site, and would be protective of human health and the environment if long-term maintenance of the soil cap is conducted and property use restrictions are respected. Soil Action Alternative 2 would use chemical oxidation to treat metals, but because of concerns about potential corrosive materials remaining in Facility soils and potential incomplete mixing of treatment materials with contaminants, a soil cover would be needed to restrict access after treatment and to cover any areas where organic contamination is not being addressed (i.e., via Groundwater Action Alternative 1). Soil Action Alternative 2 would require additional groundwater sampling to ensure that materials added to the soil would not negatively impact groundwater.

For Soil Action Alternative 3, the SVE treatment of VOCs would reduce VOC contaminant levels that leach to groundwater, but would ultimately leave metals untreated. A soil cover would again be necessary to restrict access to Facility soils. These alternatives offer some degree of protection to human health, but rely on thorough implementation of the treatment process and the maintenance of the soil covers.

Warranty deed restrictions would be necessary to control the development of the property for all alternatives.

#### **11.1.2 Compliance with ARARs**

The No Action Soil Alternative would not meet ARARs because levels of contamination above Part 201 health-based levels would remain in Facility soils.

Soil Action Alternative 1 would be effective in achieving site-specific cleanup levels that comply with Michigan Part 201 cleanup standards because risks associated with direct contact with soil would be eliminated through excavation and off-site disposal. Excavation to meet GSI Protection Criteria for soil would also reduce the concentrations of those contaminants most likely to leach to groundwater at concentrations that could exceed GSI criteria at nearby CD #30. Under Soil Action Alternative 1, if the soil response were implemented in conjunction with Groundwater Action Alternative 1, excavation would not be extended to achieve Part 201 criteria protective of drinking water for the following reasons. VOC levels in the vadose zone would be further reduced (beyond the excavation cleanup criteria) through the air sparge/SVE process. In addition, contaminant concentrations would be expected to decrease through the natural flushing of the soil. Groundwater treatment is anticipated to continue for at least 30 years. Finally, the shutdown conditions for the groundwater treatment system will require verification that soils do not leach contaminants to groundwater in excess of the drinking water criteria.

Soil Action Alternatives 2 and 3 could meet ARARs, although the design components of the soil cover (or an alternate form of direct contact barrier) might need to be modified to meet Michigan standards.

#### **11.1.3 Long-Term Effectiveness and Permanence**

The No Action Soil Alternative would not provide for long-term effectiveness or permanence because contamination would remain in Facility soils.

Soil Action Alternative 1 would provide for long-term effectiveness and permanence because soils contaminated above the Part 201 Direct Contact Criteria and GSI Protection Criteria would be removed from the zone above the water table. For deeper soils, a warranty deed restriction would be necessary to limit activities below the water table. While the long-term effectiveness of this alternative would depend on compliance with the deed restriction limiting access below the water table, it is believed that the need for access to the saturated zone is relatively low (not including work related to the environmental cleanup of the Facility).

For Soil Action Alternatives 2 and 3, the long-term effectiveness and permanence would be less than for Soil Action Alternative 1. Soil Action Alternatives 2 and 3 rely on a soil cover to ensure the safety of future Facility workers after completion of soil treatment. The long-term effectiveness and permanence of the alternatives are therefore dependant on proper soil cover maintenance and compliance with warranty deed restrictions that limit allowable development on the property.

#### **11.1.4 Reduction In Toxicity, Mobility, or Volume Through Treatment**

The No Action Soil Alternative would not reduce the toxicity, mobility, or volume of contaminants through treatment since no action would be taken.

Since Soil Action Alternative 1 relies on excavation and off-site disposal of contaminated material, there would be no reduction of toxicity, mobility or volume through treatment. The excavated material would only be transferred to another location, albeit a secure landfill. As previously noted, although treatment prior to disposal would not be required, the L.A. Darling Company has indicated that they would stabilize any excavated material prior to disposal, in order to render it non-hazardous. This voluntary additional of treatment prior to disposal would reduce contaminant mobility.

Soil Action Alternative 2 would reduce toxicity, mobility and volume through treatment. The chemical oxidation proposed for Soil Action Alternative 2 would be effective in reducing the toxicity of the metal contaminants in Facility soils.

The SVE proposed for Soil Action Alternative 3 would remove VOCs from unsaturated soils. The degree of treatment for Soil Action Alternative 3 would depend on how the captured vapors are managed.

#### **11.1.5 Short-Term Effectiveness**

All alternatives except the No Action Soil Alternative would pose some degree of short-term risks during implementation. While U.S. EPA believes that the short-term risks from all Soil Action Alternatives are minimal, the short-term risks associated with Soil Action 1 are slightly higher than those for Soil Action Alternatives 2 and 3 because excavation is a more intrusive activity. All short-term impacts associated with Soil Action Alternatives 1 - 3 can be addressed with engineering controls and air monitoring to ensure the safety of workers and the public. Transportation risks associated with off-site disposal can be addressed through regulating work hours, ensuring that truck drivers obey speed limits, and, if necessary, requiring personnel to direct traffic in areas of entrance and exit.

Because the Facility is such a small area, the implementation of Soil Action Alternatives 1 – 3 could all be completed within a year of the finalization of the remedial design. However, the design process for Soil Action Alternative 1 would be significantly shorter than for Soil Action Alternatives 2 and 3. Ultimately, implementation of Soil Action Alternative 2 or 3 could take an additional year because of the complexities involved with planning and verifying soil treatment and finalizing the design components of the soil cover.

#### **11.1.6 Implementability**

The No Action Soil Alternative would require no technical implementation and is therefore the easiest alternative to implement. For the action alternatives, Soil Action Alternative 1 would be easier to implement than Soil Action Alternatives 2 and 3 because the excavation process is straightforward. Soil Action Alternatives 2 and 3 require more complex preparations to ensure that the treatment approach is properly designed and that the soil cover (or alternate exposure barrier) would be consistent with MDEQ ARARs. Soil Action Alternatives 2 and 3 also would require more Operations and Maintenance (O&M) since maintenance would be required for the soil covers.

#### **11.1.7 Cost**

The total present worth costs of each soil alternative, from highest to lowest, are as follows:

- (1) Soil Action Alternative 2 at \$1,092,270;
- (2) Soil Action Alternative 3 at \$808,680;
- (3) Soil Action Alternative 1 at \$623,566; and
- (4) The No Action Soil Alternative at \$0.

### **11.1.8 State Acceptance**

The State of Michigan, as represented by the MDEQ, has indicated its support for Soil Action Alternative 1. The MDEQ does not believe that a No Action Alternative would be protective at the site. The MDEQ has expressed concerns that Soil Action Alternatives 2 and 3 would limit future development at the property. Soil Action Alternatives would also rely on soil cover that would need to be evaluated and potentially modified to ensure ARAR compliance.

### **11.1.9 Community Acceptance**

U.S. EPA received very few comments on the proposed cleanup plan. However, the City Manager and one resident did express support for Soil Action Alternative 1. No comments were received on the other soil alternatives.

## **11.2 Interim Action Groundwater Alternatives**

### **11.2.1 Overall Protection of Human Health and the Environment**

The No Action Groundwater Alternative would not provide any protection of human health and the environment. Groundwater contamination at the Facility would continue to migrate off site and no action would be taken to commence the removal of the VOC mass from the saturated zone.

As an interim action, any of the groundwater action alternatives 1 – 3 would be a step forward in the protection of human health and the environment by commencing the removal of high concentration VOC contamination from below the Facility. By using a two-phase approach (air sparging and then groundwater extraction and treatment), Groundwater Action Alternative 1 would be more aggressive in attacking the VOC mass below the Facility. Groundwater Action Alternatives 2 and 3 are very similar (they differ in the treatment approach for the extracted groundwater) and each would help reduce the amount of groundwater contamination moving off site. The groundwater extraction approach outlined in Groundwater Action Alternatives 2 and 3 would not significantly change the amount or type of contaminant degradation in groundwater at the Facility. Groundwater Action Alternative 1, however, would introduce oxygen into the saturated zone. This could change the degradation mechanism for contaminants in groundwater that are not fully volatilized. Groundwater monitoring would therefore track changes in contaminant concentrations and evaluate any potentially harmful degradation byproducts.

Combined with warranty deed restrictions at the Facility, a municipal ordinance that limits private well use in contaminated areas, and continued private well monitoring by the Branch-Hillsdale-St. Joseph Community Health Agency under contract to the MDEQ Water Bureau, U.S. EPA believes that any of the groundwater action alternatives are a step forward in achieving overall protection of human health and the environment. As the groundwater action alternatives are an interim measure, a final ROD will be necessary to ensure overall protection of human health and the environment from contaminated groundwater both at the former L.A. Darling facility and downgradient of the Facility, including areas where contaminant plumes from multiple source areas overlap.

### **11.2.2 Compliance with ARARs**

There are no ARAR issues associated with the No Action Groundwater Alternative.

For Groundwater Action Alternatives 1 - 3, action-specific ARARs would need to be met to ensure proper management of extracted groundwater and captured vapors. Chemical-specific standards would apply to air releases and groundwater discharges; however, no chemical-specific cleanup standards are being set for Facility groundwater as part of this ROD's selection of an interim groundwater action. Cleanup standards for contaminated groundwater will be set in a final comprehensive ROD that will identify consistent cleanup requirement for the NBFF contaminated groundwater plumes.

### **11.2.3 Long-Term Effectiveness and Permanence**

The No Action Groundwater Alternative is not effective or permanent. No action would be taken to address groundwater contamination at the Facility and no engineering or administrative controls would be put in place to limit the potential future use of groundwater.

Groundwater Action Alternatives 1 – 3 would all permanently remove contamination from the saturated zone. However, under any scenario, groundwater treatment at the Facility is anticipated to be necessary for at least thirty years. Groundwater Action Alternative 1 is expected to provide a more rapid reduction of VOC mass from the saturated zone than what would be obtained through Groundwater Action Alternatives 2 and 3. It is not known which approach (groundwater extraction or a two-phase approach with air sparge/SVE and groundwater extraction) would ultimately result in the greatest reduction of VOCs moving off-site in the short term. However, it is expected that by maximizing removal of VOC through air sparging, Groundwater Action Alternative 1 would provide for a more rapid improvement in groundwater contaminant concentrations. Groundwater Action Groundwater Alternative 1 would also reduce VOC levels above the water table to levels below direct contact criteria through the process of extraction of the vapors from the sparge/SVE system.

The administrative controls proposed for Groundwater Action Alternatives 1 – 3 would be useful additions to the groundwater interim action and air in its long-term effectiveness. By modifying the Facility deed to restrict groundwater use at the property and encouraging the City of Bronson to enact a groundwater use restriction ordinance, the interim action reduces the potential for future potable use of groundwater. These administrative actions recognize that even with active treatment, groundwater contaminant concentrations will remain above safe levels for many, many years.

### **11.2.4 Reduction of Mobility, Toxicity, or Volume Through Treatment**

There is no reduction of mobility, toxicity or volume through treatment under the No Action Groundwater Alternative.

Under Groundwater Action Alternatives 1, the Phase 1 air sparge system would inject air into the saturated zone to liberate VOCs and SVE would extract VOC vapors. This process is basically a transfer of contamination from one media to another. The actual degree of reduction in mobility, toxicity or volume would depend on the vapor treatment approach developed during remedial design. If an afterburner proves to be necessary to treat the VOC-contaminated vapors, there would be active destruction of contamination.

For Groundwater Action Alternative 2 and Phase 2 of Groundwater Action Alternative 1, the groundwater extraction systems remove contamination from the groundwater and then rely on various separation techniques (air stripping, carbon filtration and chemical precipitation) to clean the extracted groundwater. The degree of treatment will depend on how the vapor from the air stripper is handled. Even if thermal treatment of the vapors is not necessary, there is often an indirect treatment of contamination in that the granular activated carbon (which would contain trapped contamination) is often thermally treated to allow for reuse. Groundwater Action Alternative 3 provides the most direct treatment of contamination by using ozone to destroy VOC contamination in the extracted groundwater.

#### **11.2.5 Short-Term Effectiveness**

The No Action Groundwater Alternative would not involve any action; therefore, no time is required for implementation.

Groundwater Action Alternatives 1, 2 and 3 provide for groundwater use restrictions to be placed on the title to the Facility and requires coordination with the City of Bronson for the development and passage of an ordinance restricting use of groundwater from contaminated areas of the aquifer. These actions would be useful additions to the interim action and provide an additional layer of human health protection.

All active groundwater alternatives would present short-term construction-related risks to the community and workers associated with site activities. These risks include increased traffic, and potential exposure to contaminated groundwater through accidental spills or leaks. Since Groundwater Action Alternative 1 is a two-phase approach, follow-up construction activities would be necessary after the initial system installation to convert from an air sparge/SVE system to a groundwater extraction and treatment system. However, the disturbance from this changeover is thought to be minimal.

There are specific short-term effectiveness issues associated with Groundwater Action Alternative 1 and Groundwater Action Alternative 3. For Groundwater Action Alternative 1, air will be introduced into the saturated zone to volatilize VOCs. Contaminated vapors will then be extracted from the property through an SVE system. As part of this process, additional soil cover (such as an impermeable barrier) may need to be placed on the property to reduce the “short-circuiting” in the vapor extraction system. The introduction of air into the saturated zone also raises the risk that the system could exacerbate vapor intrusion problems beyond the Facility boundary if the system is not properly designed. Therefore, the air sparge/SVE will need to be designed with thorough controls and perimeter monitoring to track the performance of the system.

For Groundwater Action Alternative 3, contaminated groundwater would be treated with ozone, and the ozone would need to be generated at the site. There are potential noise and safety issues associated with ozone generation so close to residences. These issues would need to be thoroughly addressed during remedial design, and the City of Bronson would need to be brought into the process to ensure that the local government would be comfortable with the controls to be put in place.

All groundwater action alternatives would require approximately one year for the preparation and review of detailed design plans. Construction could be completed in one construction season. The timeframe for groundwater treatment is expected to be in excess of 30 years.

### **11.2.6 Implementability**

Other than the No Action Groundwater Alternative, Groundwater Action Alternative 2 would be the easiest groundwater alternative to implement. Groundwater Action Alternative 2 would be a single-phase interim action and would not require specialized planning for the generation of ozone. Groundwater Action Alternative 1 will require additional up-front planning to ensure that the air sparging does not exacerbate vapor intrusion problems in the neighborhood. Groundwater Action Alternative 1 will require close coordination with U.S. EPA and MDEQ regarding monitoring results and for the discussions as to when it is appropriate to convert to the groundwater extraction phase of the project.

### **11.2.7 Cost**

The present worth costs of the interim action groundwater alternatives are, from highest to lowest, as follows:

- (1) Groundwater Action Alternative 2 at \$2,053,000;
- (2) Groundwater Action Alternative 3 at \$1,463,695;
- (3) Groundwater Action Alternative 1 at \$1,371,000; and
- (4) The No Action Groundwater Alternative at \$0.

### **11.2.8 State Acceptance**

The State of Michigan, as represented by the MDEQ, has indicated its support for Groundwater Action Alternative 1 as an interim action at the former L.A. Darling facility.

### **11.2.9 Community Acceptance**

Comments from the City of Bronson did not specifically address the groundwater alternatives. One resident provided a written comment indicating support for Groundwater Action Alternative 1. ITT Industries also provided comments, identifying two technical issues related to the design and monitoring of the groundwater remedy.

## **12.0 PRINCIPAL THREAT WASTES**

While concentrations of contaminants in soil, UST liquids, and sewer sediment may exceed the Michigan Part 201 criteria appropriate for industrial use of the property, the contaminant concentrations do not approach levels that warrant consideration of the materials as principal threat wastes. Plating sludge identified during the RI has already been excavated by the L.A. Darling Company as part of the 2007/2008 voluntary action at the property (performed in preparation for the construction/restoration of Railroad Street through a portion of the property).

Concentrations of organics in groundwater indicate that VOCs may be present as Dense Non-Aqueous Phase Liquid (DNAPL) below the Facility. The potential for DNAPL will be addressed by requiring any groundwater extraction system to accommodate the potential for high-level VOC influent.

## **13.0 SELECTED REMEDY**

### **13.1 Summary of the Rationale for the Selected Remedy**

U.S. EPA evaluated the soil and groundwater alternatives based on U.S. EPA's nine criteria. These criteria are summarized in Section 11 of this ROD and in Table 7, located in Appendix A to this ROD. In making its cleanup decision, U.S. EPA looked for alternatives that satisfied the two threshold criteria (Protection of Human Health and the Environment and Achievement of ARARs) and provided the best balance of the remaining criteria. U.S. EPA made its recommendation for the former L.A. Darling facility in a Proposed Plan and considered public comment. U.S. EPA has carefully evaluated the cleanup alternatives that have been developed and public comment that has been received. U.S. EPA's goal is to achieve a cleanup that protects human health and the environment, meets federal and state standards, and allows for redevelopment.

U.S. EPA has evaluated soil alternatives that address VOC and metal contamination at the Facility. U.S. EPA has determined that Soil Action Alternative 1, with excavation and off-site disposal, is the most efficient and appropriate response for the property. The No Action Alternative is not appropriate given the exceedances of Part 201 direct contact criteria and the City's desire that the property be made available for redevelopment. Soil Action Alternatives 2 and 3 utilize treatment to address contamination, but given the small size of the property and the mixed contamination at the site, on-site treatment is not cost effective and will not ensure that cleanup standards are consistently achieved across the property. With the exception of the No Action Soil Alternative, Soil Action Alternative 1 would be the least expensive soil alternative. The excavation and off-site disposal approach would also be a continuation of the voluntary work completed by the L.A. Darling Company in 2007/2008.

U.S. EPA has selected Groundwater Action Alternative 1 as an interim remedy for the former L.A. Darling facility. U.S. EPA believes that it is appropriate to try to maximize the removal of VOCs from the saturated zone below the property. By using a two-phase approach with air sparging/SVE and groundwater extraction, the treatment system structures can do double duty, giving the flexibility to shift to groundwater extraction when the air sparging/SVE no longer provides an effective mechanism for VOC removal.

### **13.2 Description of the Selected Remedy – Soil Action Alternative 1 and Groundwater Action Alternative 1**

By this ROD, U.S. EPA is selecting a cleanup plan that provides a final remedy for Facility soils and an interim remedy for Facility groundwater. The soil cleanup plan was developed to address industrial worker and construction worker safety issues associated with direct contact to contaminated materials and to allow for industrial/commercial redevelopment of the property to the maximum extent possible.

The interim action groundwater remedy was developed with the expectation that a final ROD would be developed to address broader NBFF groundwater contamination. The focus of the interim action is to remove mass at the source area and, ultimately, to remove the Facility as a source of contamination to the aquifer. The system should be designed so that at steady-state, groundwater extraction wells will contain and control groundwater movement.

Michigan Part 201 Industrial and Commercial Direct Contact Criteria and Michigan Part 201 GSI Protection Criteria are identified as the appropriate cleanup standard for unsaturated Facility soils and can be found in Table 8 and 9 in the Appendix A to this ROD. Because there has been industrial activity

at the property for nearly 100 years, it is important to recognize that additional types and areas of contamination may be encountered during remedial design and remedial action activities at the Facility. Although this ROD focuses on VOC and inorganic contamination known to exist on the property, the Part 201 Industrial and Commercial Direct Contact Criteria and the Michigan Part 201 GSI Protection Criteria are established to address any exceedances identified during design and cleanup. Therefore, if unknown types or areas of soil contamination are identified during future work, the area in question should be fully characterized and included, as appropriate, within the area requiring excavation.

The components of the selected remedy include:

- Excavation and off-site disposal of contaminated subsurface structures, sewers, and USTs;
- Excavation and off-site disposal of contaminated soil, as necessary to reach Michigan Part 201 Industrial and Commercial Direct Contact Criteria and Michigan Part 201 GSI Protection Criteria (for those contaminants that pose a risk of creating an exceedance of the GSI criteria in groundwater at CD #30). Verification during remedial design that extent of excavation is sufficient to address potential ecological risks. If contamination extends below the water table, soil excavation may be limited to the area above the water table;
- Excavation below the water table, using best engineering practices, for sludge and hot-spot areas of contamination;
- Restoration of the site to current grades;
- Construction of an air sparge/SVE treatment system to remove VOC contamination from below the water table;
- Operation, maintenance and monitoring of the air sparge/SVE treatment system;
- Conversion of the air sparge / SVE system to a groundwater extraction/treatment system upon U.S. EPA agreement or upon U.S. EPA direction, in consultation with MDEQ. The determination as to when it is appropriate to move to groundwater extraction and treatment is to be based on air sparge recovery rates and groundwater and soil gas contaminant concentration;
- Operation, maintenance and monitoring of groundwater extraction and treatment system;
- Discharge of treated water to CD #30;
- Placement of a warranty deed restriction on the property to limit land use to industrial/commercial purposes, limit intrusive activities below the water table, and prohibit groundwater use;
- Coordination with the City of Bronson to draft and pass an ordinance restricting groundwater use in areas of groundwater contamination;
- Coordination with the MDEQ Water Bureau concerning routine monitoring of private wells that have the potential to be impacted by groundwater contamination from the former L.A. Darling facility; and

- Monitor deed restrictions to ensure that land use is consistent with the cleanup levels selected for the Facility.

Soil Alternative 1 does not require the excavation of Facility soils to the Part 201 criteria protective of drinking water. However, the air sparge SVE/groundwater extraction treatment system in combination with natural flushing should continue to reduce residual contaminant concentrations in unsaturated soils to levels protective of the drinking water pathway. Groundwater use restrictions will also be required. Conditions for system shutdown will include verification that facility soils no longer pose a threat to residential drinking water.

### 13.3 Summary of the Estimated Costs of the Selected Remedy

A more detailed breakdown of the estimated costs for the selected alternatives is presented in Tables 10 and 11, which can be found in Appendix A to this ROD. The following table summarizes the capital costs, O&M and NPV for Soil Action Alternative 1 and Groundwater Action Alternative 1. The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternatives. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

	Capital Cost (including standard construction contingency)	O&M / Year	Total O&M (expressed as the NPV of O&M)	Net Present Worth of Alternative
Soil Action Alternative 1	\$ 583,566	\$ 5,000 / year for 5 years	\$ 40,000	\$ 623,566
Groundwater Action Alternative 1 (Interim Remedy)	\$ 455,000	\$ 114,500 / year for 30 years	\$ 916,000 using a 12% discount rate  (Discount rate is specific to company funds / demonstrated return – Berkshire Hathaway, Inc.)	\$ 1,371,000

### 13.4 Expected Outcomes of the Selected Remedy

The Selected Remedies, Soil Action Alternative 1 and Groundwater Action Alternative 1, meet the remedial action objectives:

#### RAOs for Soil

- Prevent direct contact with or ingestion of soil exceeding applicable criteria for all potential receptors.

- Reduce contaminant concentrations in soil to levels protective of the GSI (for those parameters which pose a risk of creating an exceedance of the GSI criteria in groundwater at CD #30).
- Allow for industrial redevelopment of the property.

#### **Interim Action RAOs for Groundwater**

- Reduce VOC mass from the saturated zone below the former L.A. Darling facility.
- In the short-term, reduce the VOC concentrations in and volume of contaminated groundwater moving beyond the Facility perimeter.
- In the long-term, the goal is to contain and control Facility groundwater to eliminate the former L.A. Darling facility as a source of contamination to the aquifer.
- Prevent ingestion of groundwater exceeding maximum contaminant levels (MCL) and Michigan Part 201 Residential and Commercial Drinking Water Protection criteria at the Facility.

### **13.5 Statutory Determinations**

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

#### **13.5.1 Protection of Human Health and the Environment**

The selected soil remedy, Soil Action Alternative 1, will protect human health and the environment through the removal and off-site disposal of soils that contain contaminants in excess of health-based levels and levels which could cause an exceedance of the ecologically-based GSI criteria at CD #30. Verification sampling will be required after excavation to ensure that the soil cleanup is complete. Using deed restrictions or other institutional controls as needed, the Selected Remedy will ensure that future land use is consistent with the cleanup levels that have been established for the site and that activities below the water table are appropriately controlled. Site-specific cleanup levels have not been developed for the site from the human health risk assessment. The cleanup levels utilized are based on Michigan Part 201 human health and ecologically-based cleanup criteria.

The selected interim groundwater remedy, Groundwater Action Alternative 1, is an appropriate first step to address high concentration groundwater contamination at the Facility. Deed restrictions limiting groundwater use and efforts to implement a city ordinance limiting the use of private wells in areas of groundwater contamination provide an interim measure of control regarding groundwater use. A final ROD will establish cleanup actions for the NBFF groundwater plumes, and will also potentially address overlapping NBIA groundwater contamination. Long-term groundwater monitoring will be used to evaluate the performance of the treatment system. Should data indicate that the air sparge/SVE system is exacerbating vapor intrusion problems in the neighborhood, U.S. EPA may elect to direct the cessation of

air sparging at the Facility and require an accelerated conversation of the system to allow for groundwater extraction and treatment.

### **13.5.2 Compliance with Applicable or Relevant and Appropriate Requirements**

The selected soil remedy and interim groundwater remedy will comply with all ARARs. The ARARs presented in Tables 4, 5 and 6 in Appendix A have been determined to be applicable or relevant and appropriate to the selected cleanup alternatives. Chemical-specific cleanup standards for groundwater will be identified at the time a final groundwater remedy is selected.

Chemical, Location, and Action-Specific ARARs include the following:

- Soil Cleanup Levels - Michigan Part 201 of Michigan's Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended.
- Management of Site Wastes - The Michigan Natural Resource and Environmental Protection Act, NREPA Part 111, and its implementing regulations in R 299.9301 of the Michigan Administrative Code require generators of hazardous waste to properly identify, store, and dispose of hazardous waste. Contaminated soil at the former L.A. Darling site may be hazardous waste.
- Erosion Control - The Michigan Soil Erosion and Sedimentation Control Act (Part 91) provides measures to control soil erosion and sedimentation of state surface waters.
- Control of Air Releases - The Michigan Air Pollution Act (Part 55) provides measures to control air emissions of critical pollutants from various air contaminant source categories and processes that could affect human health and the environment.
- Control of Air Releases - The federal CAA establishes National Ambient Air Quality Standards (NAAQS) for some "criteria pollutants" expressed as primary and secondary allowable short- and long-term concentrations (expressed as micrograms per cubic meter in air).
- Control of Air Releases - Emission limitations for new and existing sources of hazardous pollutants have been developed under the federal National Emission Standards for Hazardous Air Pollutants (NESHAP).
- Water Discharges - Part 31, Water Resources Protection, of the NREPA: Part 31 establishes effluent standards in accordance with the federal Water Pollution Control Act and the CWA. Part 31 would be applicable to the discharge of water from the site to CD #30.

### **13.5.3 Cost-Effectiveness**

In the lead agency's judgment, the selected remedies are cost-effective and represent a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then

compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of the remedial alternatives was determined to be proportional to their costs and hence the selected alternatives represent a reasonable value for the money to be spent. The estimated present worth cost of the selected soil remedy is \$ 623,566. The cost for Soil Action Alternative 1 is reasonable given that it is the least expensive action alternative and requires no long-term O&M beyond the implementation of the deed restrictions limiting activities below the water table.

The present worth cost of the selected interim groundwater remedy is estimated at \$ 1,371,000. This alternative is slightly cheaper than the other groundwater action alternatives. The air sparge/SVE approach allows for in-situ stripping of VOCs from groundwater, which is more cost-effective and potentially more effective than traditional groundwater extraction and treatment. Once the air sparge approach no longer provides for efficient recovery, the system will be converted to groundwater extraction and treatment. U.S. EPA feels that the cost of the selected interim remedy is appropriate given the levels of groundwater contamination at the property.

#### **13.5.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable**

U.S. EPA has determined that the selected soil remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, U.S. EPA has determined that the selected soil remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering state and community acceptance. The selected soil remedy satisfies the criteria for long-term effectiveness by removing contaminated soil from the Facility. The selected soil remedy does not present short-term risks different from the other soil action alternatives.

While the interim groundwater remedy is not designed or expected to be final, the selected groundwater remedy represents the best balance of trade-offs among alternatives with respect to pertinent criteria, given the limited scope of the action. While the selected interim groundwater remedy has the potential to exacerbate vapor intrusion problems beyond the Facility boundary, this risk can be controlled through proper system design and monitoring. There are no special implementability issues that set the selected soil remedy and selected interim groundwater remedy apart from any other alternatives evaluated.

#### **13.5.5 Preference for Treatment as a Principal Element**

The selected soil remedy requires excavation and off-site disposal of contaminated soils from the site. There is no treatment component to the selected soil remedy, and the remedy therefore does not satisfy U.S. EPA's preference for treatment as a principal remedy element.

Because this action does not constitute the final remedy for contaminated groundwater at and from the former L.A. Darling facility, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action for NBFF groundwater. For the interim groundwater remedy, contaminants will be separated from groundwater by in-situ air sparging and by ex-situ treatment (air stripping, granular activated carbon, chemical precipitation). The ultimate disposition of contaminants separated by air sparging and groundwater treatment will depend on the types of media used and whether or not they can be regenerated. With the influent concentrations anticipated from the air sparging

system, it is possible that an afterburner could be necessary to destroy VOC contaminants in the collected vapors.

#### **13.5.6 Five-Year Review Requirements**

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

#### **13.6 Documentation of Significant Changes**

No changes to the proposed alternatives were warranted based on the public comments received on the Proposed Plan. Based on a re-review of the RI data, U.S. EPA has added the requirement that the remedial design for the soil remedy verify that the work to be completed will address any ecological risks posed by soil contamination on the property. Should the assessment find that Michigan Part 201 industrial/commercial cleanup criteria are insufficient to address potential ecological risks, the extent of excavation should be modified, as necessary, to address additional areas of soil contamination.

**Former L.A. Darling Facility**  
**Operable Unit 2**  
**of the**  
**North Bronson Former Facilities Site**  
**Bronson, Michigan**

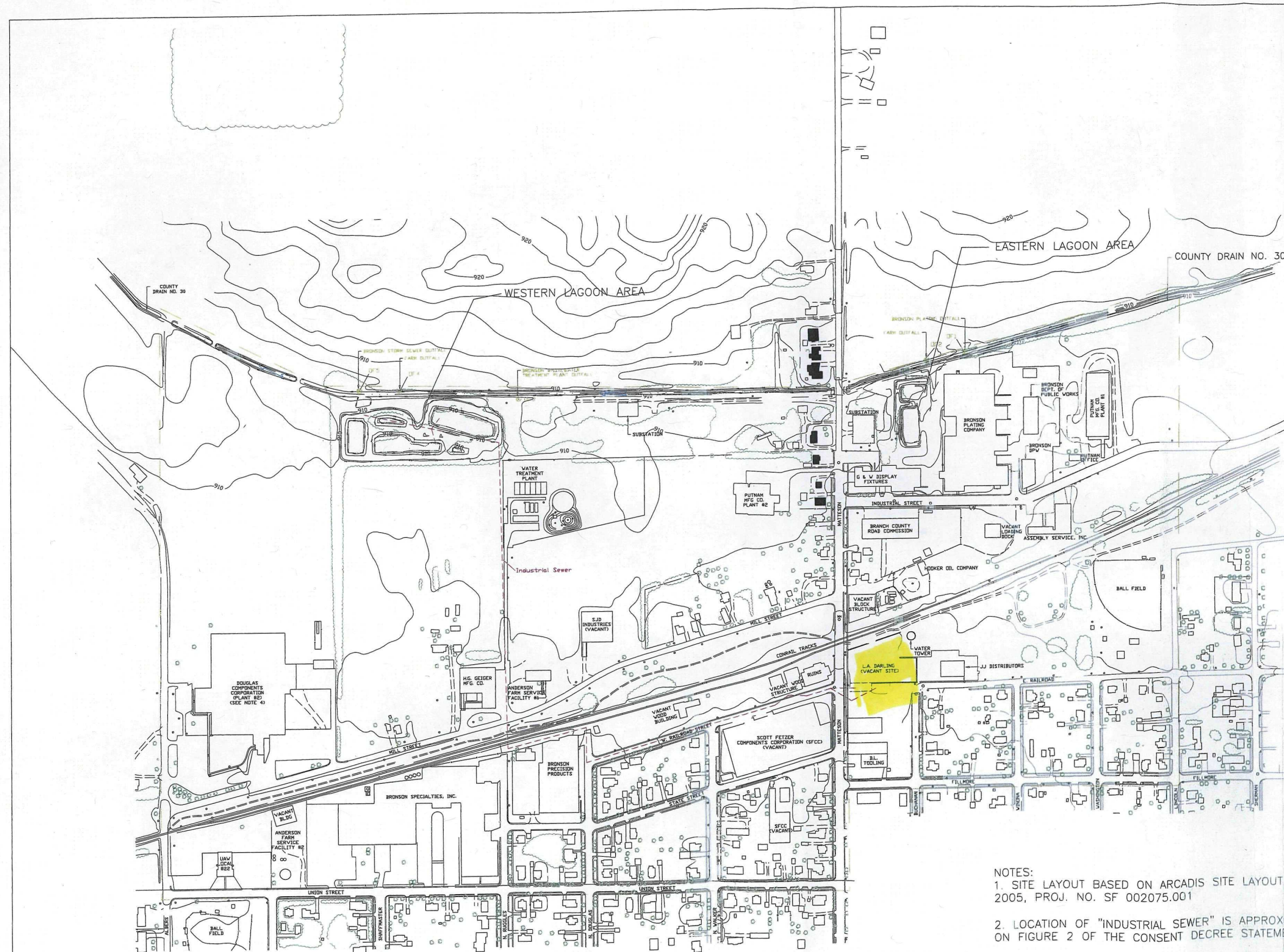
**Appendix A**  
**to the**  
**Record of Decision**

**FIGURES AND TABLES**

# Figure 1

PATH: \Projects\12716 NBIA DUL PIP Group\41686\DWG\US EPA SITE LAYOUT.DWG

PLAT DATE: 06/13/08 CSY



NOTES:  
 1. SITE LAYOUT BASED ON ARCADIS SITE LAYOUT, ARCADIS, MARCH 3, 2005, PROJ. NO. SF 002075.001  
 2. LOCATION OF "INDUSTRIAL SEWER" IS APPROXIMATE AND BASED ON FIGURE 2 OF THE CONSENT DECREE STATEMENT OF WORK.

- LEGEND
- APPROXIMATE SITE BOUNDARY
  - ⊗ OUTFALL LOCATION AND NUMBER
  - SURFACE-WATER FLOW DIRECTION
  - RESIDENTIAL STRUCTURE WITHIN EASTERN LAGOON AREA STUDY AREA
  - - - APPROXIMATE INDUSTRIAL SEWER

NORTH BRONSON  
 INDUSTRIAL AREA SITE  
 BRONSON, MICHIGAN

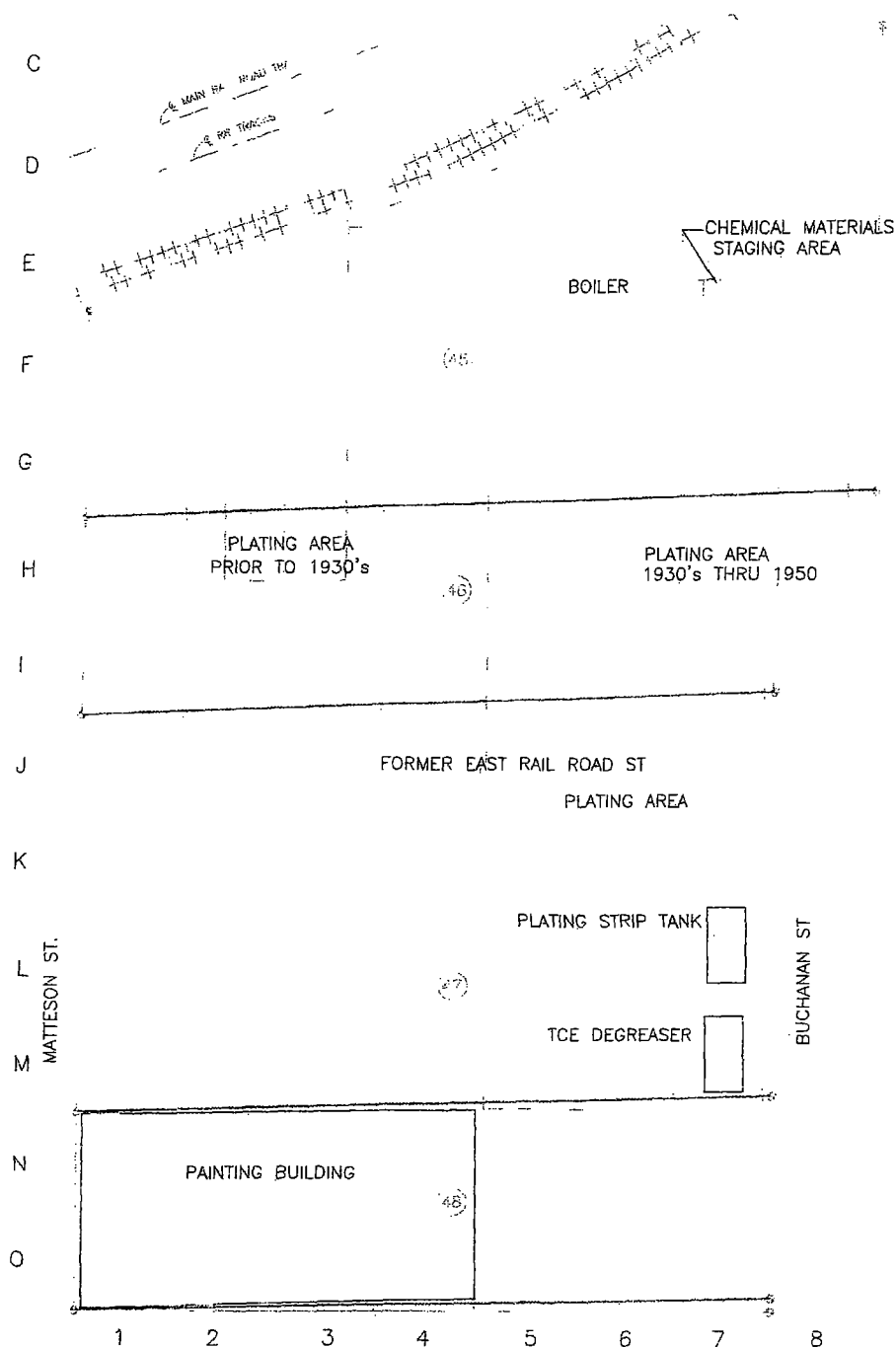
SITE LAYOUT

1"=200' 200 0 200

FILE NO. 12716.41686  
 JUNE 2008

**O'BRIEN & GERE**  
 ENGINEERS, INC.

# Figure 2



**FUTURE LAND USE**  
 LOTS 45 & 46 - PROPOSED BROWNFIELD REDEVELOPMENT  
 VACATED RAILROAD LOT - PROPOSED REPLACED RAILROAD STREET  
 LOT 47 - PROPOSED GREEN BELT  
 LOT 48 - PROPOSED PAVED AREA

**HISTORICAL LAND USE**  
 PAINTING BUILDING - HISTORICAL LAND USE PAINTING BUILDING

**NOTE**  
 TCE = TRICHLOROETHENE  
 LOT = LOT NUMBER  
 --- = LOT BOUNDARY  
 D,2 = GRID LOCATION IDENTIFIERS

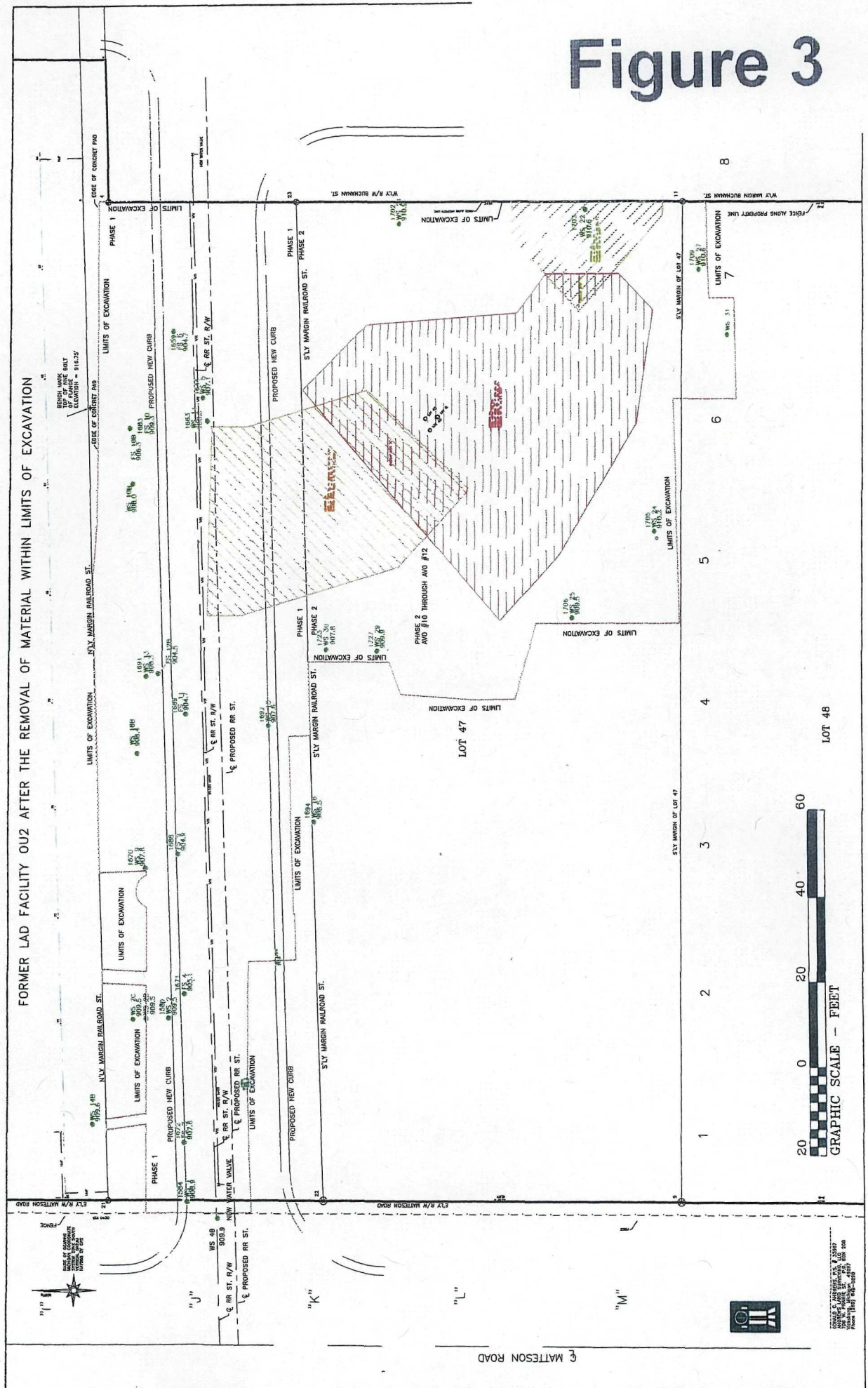
**SOURCE OF SURVEY:**  
 ANDREWS LAND SURVEYING, STURGIS, MICHIGAN (P.S.#33967), MAY 2001.

**NOTE:**  
 FIGURE DEVELOPED BY MONTGOMERY WATSON HARZA.

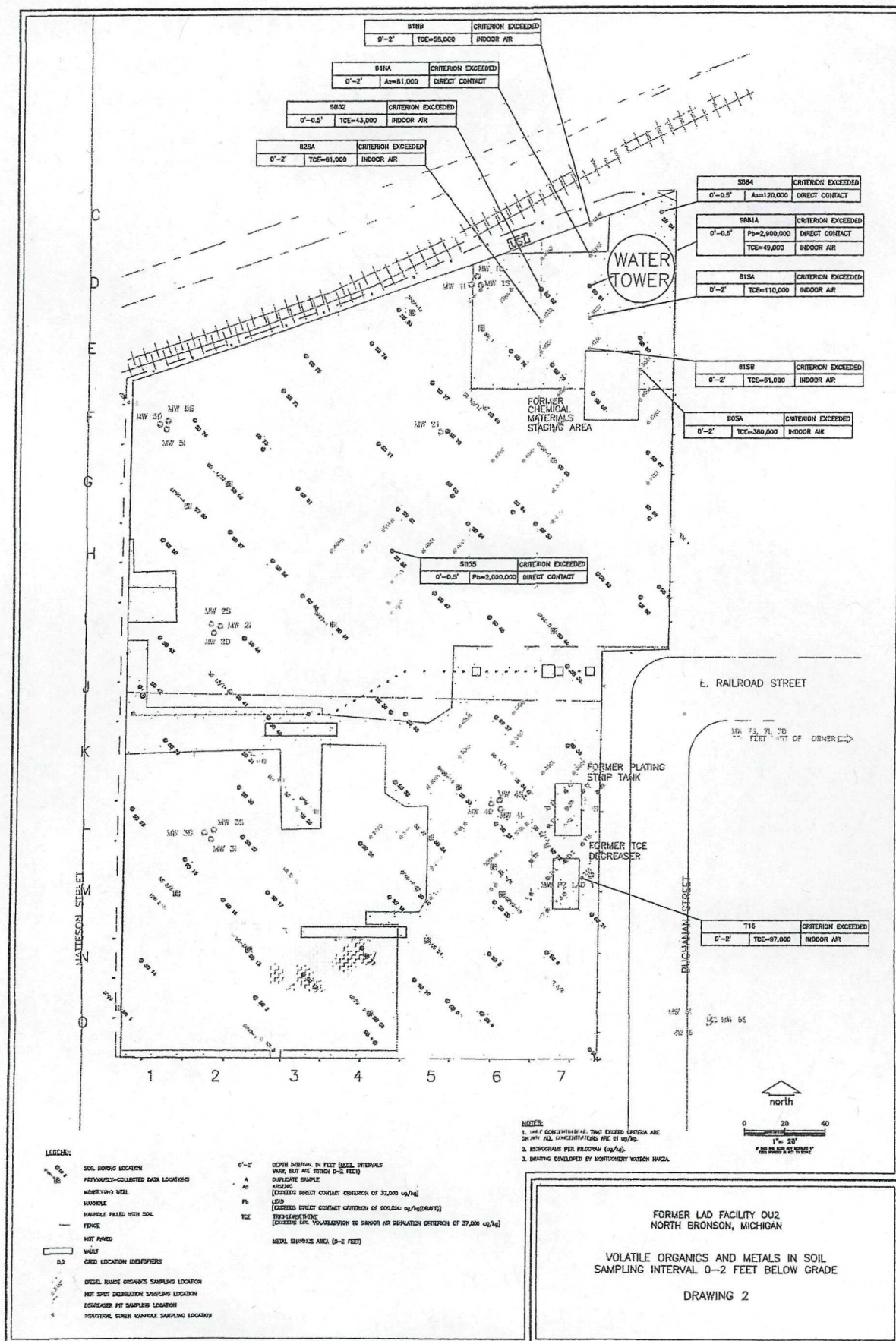
FIGURE 1-3  
 HISTORICAL LAND USE

FORMER LAD FACILITY OU2, NORTH BRONSON, MICHIGAN

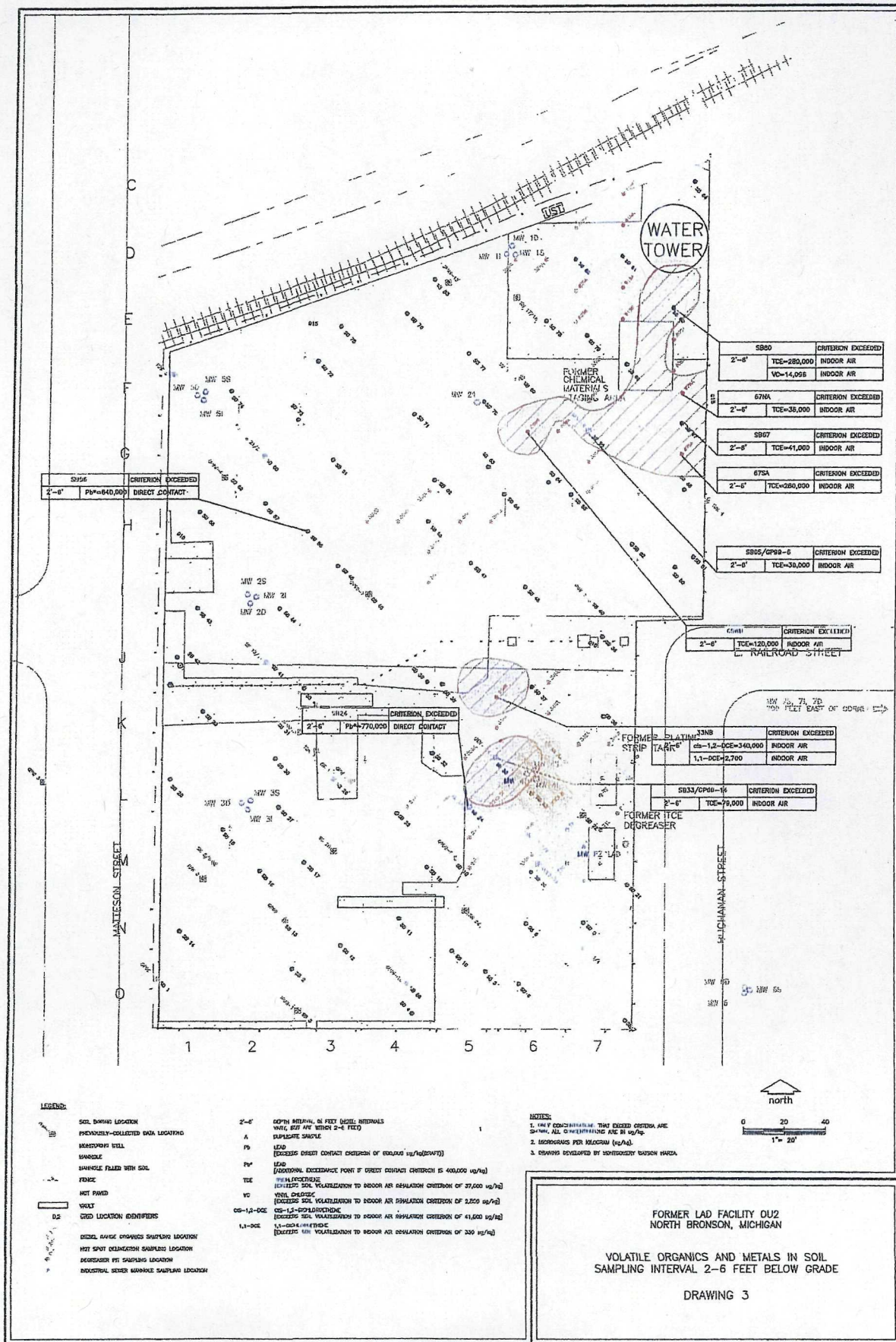
### Figure 3



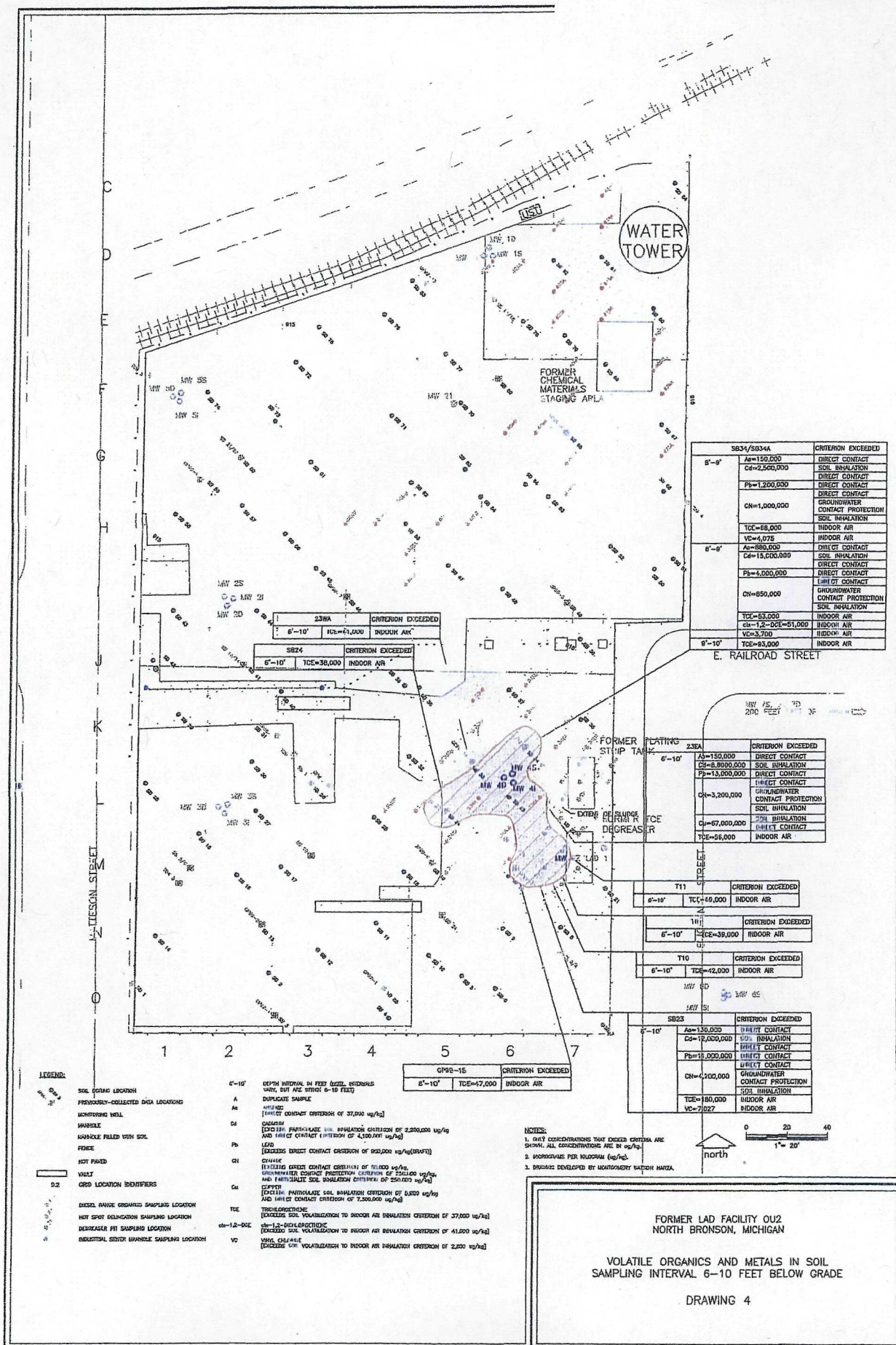
# Figure 4



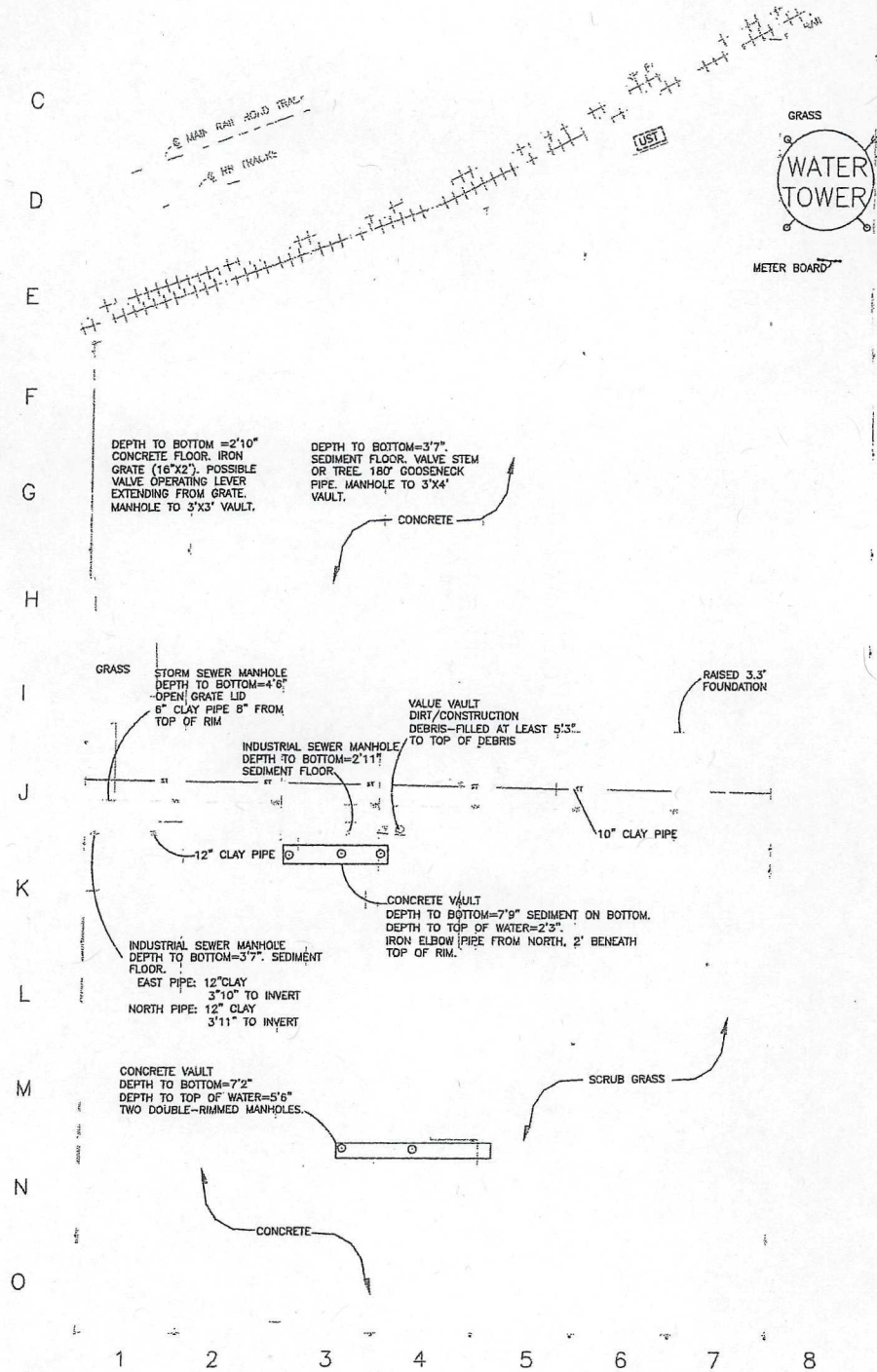
## Figure 5



# Figure 6



# Figure 7



## LEGEND:

MONITORING WELL	IS = INDUSTRIAL SEWER
MANHOLE	ST = STORM SEWER
MANHOLE FILLED WITH SOIL	WM = WATER MAIN
FENCE	
D,2	GRID LOCATION IDENTIFIERS
CONCRETE	

NOTE:  
FIGURE DEVELOPED BY MONTGOMERY WATSON HARZA.

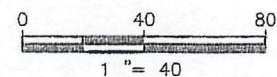


FIGURE 2-1  
FACILITY FEATURES

FORMER LAD FACILITY OU2, NORTH BRONSON, MICHIGAN

## Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – Surface Soils

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> Surface Soil (0-2 feet) <b>Exposure Medium:</b> Soil								
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Surface Soil On-Site	Chloroethane			ppb	0/111	230	ppb	c
	1,1-Dichloroethane			ppb	0/111	113	ppb	c
	1,2-Dichloroethane			ppb	0/111	113	ppb	c
- Dermal Contact for Industrial Worker	1,1-Dichloroethene			ppb	0/111	116	ppb	c
	cis-1,2-Dichloroethene	18	14,000	ppb	12/112	1,105	ppb	c
	trans-1,2-Dichloroethene	160	160	ppb	1/90	136	ppb	c
	1,1,2,2-Tetrachloroethane			ppb	0/109	138	ppb	c
- Incidental Ingestion for Industrial Worker	Tetrachloroethene	53	6900	ppb	5/112	735	ppb	c
	1,1,1-Trichloroethane			ppb	0/111	112	ppb	c
	1,1,2-Trichloroethane			ppb	0/111	113	ppb	c
	Trichloroethene	11	380000	ppb	93/112	55,525	ppb	a
	Vinyl chloride	260	260	ppb	1/111	139	ppb	c
	Arsenic	1,100	120,000	ppb	129/129	12,679	ppb	b
	Barium	7,900	1,700,000	ppb	129/129	153,593	ppb	b
	Cadmium	62	478,000	ppb	114/129	168,526	ppb	a
	Chromium (III)	7,000	1,490,000	ppb	129/129	238,386	ppb	c
	Hexavalent Chromium	1,600	66,000	ppb	5/8	77,561	ppb	e
	Copper	3,300	19,000,000	ppb	129/129	647,465	ppb	a
	Lead	3,600	2,900,000	ppb	134/134	275,977	ppb	c
	Selenium	100	2,900	ppb	71/129	721	ppb	b
	Silver	110	140,000	ppb	89/129	8,532	ppb	c
	Zinc	7,200	9,000,000	ppb	129/129	671,801	ppb	c
	Mercury	72	25,000	ppb	83/129	1,496	ppb	c
	Cyanide	58	190,000	ppb	81/130	17,214	ppb	c

Statistical Measure: Data was analyzed using U.S. EPA's ProUCL (v. 3, 2004), with ½ detection limits used for non-detects.

a. 95% H-UCL

b. 95% Chebyshev-UCL

c. 97.5% Chebyshev-UCL

e. Adjusted Gamma UCL

# Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – Surface Soils

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> Surface Soil (0-2 feet) <b>Exposure Medium:</b> Fugitive Dust from Surface Soil			
Exposure Point	Chemical of Concern	Exposure Point Concentration	Exposure Point Concentration Units
Surface Soil On-Site  - Modeled Fugitive Dust Inhalation for Industrial and Construction Worker	Chloroethane	1.74E-07	µg/m <sup>3</sup>
	1,1-Dichloroethane	8.53E-08	µg/m <sup>3</sup>
	1,2-Dichloroethane	8.53E-08	µg/m <sup>3</sup>
	1,1-Dichloroethene	8.80E-08	µg/m <sup>3</sup>
	cis-1,2-Dichloroethene	8.37E-07	µg/m <sup>3</sup>
	trans-1,2-Dichloroethene	1.03E-07	µg/m <sup>3</sup>
	1,1,2,2-Tetrachloroethane	1.04E-07	µg/m <sup>3</sup>
	Tetrachloroethene	5.56E-07	µg/m <sup>3</sup>
	1,1,1-Trichloroethane	8.52E-08	µg/m <sup>3</sup>
	1,1,2-Trichloroethane	8.53E-08	µg/m <sup>3</sup>
	Trichloroethene	4.21E-05	µg/m <sup>3</sup>
	Vinyl chloride	1.05E-07	µg/m <sup>3</sup>
	Arsenic	9.61E-06	µg/m <sup>3</sup>
	Barium	1.16E-04	µg/m <sup>3</sup>
	Cadmium	1.28E-04	µg/m <sup>3</sup>
	Chromium (III)	1.81E-04	µg/m <sup>3</sup>
	Hexavalent Chromium	5.88E-05	µg/m <sup>3</sup>
	Copper	4.91E-04	µg/m <sup>3</sup>
	Lead	2.09E-04	µg/m <sup>3</sup>
	Selenium	5.46E-07	µg/m <sup>3</sup>
	Silver	6.46E-06	µg/m <sup>3</sup>
	Zinc	5.09E-04	µg/m <sup>3</sup>
	Mercury	1.13E-06	µg/m <sup>3</sup>
	Cyanide	1.30E-05	µg/m <sup>3</sup>

Exposure Point Concentrations modeled using particulate emission factor approach for windblown dust using surface soil exposure concentrations.

# Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – All Soils

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> All Soils <b>Exposure Medium:</b> Soil								
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Soil On-Site  - Dermal Contact for Construction Worker  - Incidental Ingestion for Construction Worker	Chloroethane			ppb	0/433	545	ppb	c
	1,1-Dichloroethane			ppb	0/433	137	ppb	c
	1,2-Dichloroethane			ppb	0/433	137	ppb	c
	1,1-Dichloroethene		2,700	ppb	1/433	154	ppb	c
	cis-1,2-Dichloroethene	8.1	340,000	ppb	51/437	6,144	ppb	c
	trans-1,2-Dichloroethene	23	4,500	ppb	3/410	184	ppb	c
	1,1,2,2-Tetrachloroethane			ppb	0/422	242	ppb	c
	Tetrachloroethene	13	6,900	ppb	21/437	264	ppb	c
	1,1,1-Trichloroethane			ppb	0/432	137	ppb	c
	1,1,2-Trichloroethane			ppb	0/433	137	ppb	c
	Trichloroethene	11	380,000	ppb	369/437	24,069	ppb	d
	Vinyl chloride	71	1,100	ppb	3/424	245	ppb	c
	Arsenic	600	880,000	ppb	392/392	18,635	ppb	b
	Barium	4,000	3,900,000	ppb	392/392	155,425	ppb	c
	Cadmium	52	15,000,000	ppb	270/392	667,412	ppb	d
	Chromium (III)	3,900	110,000,000	ppb	392/392	2,592,405	ppb	c
	Hexavalent Chromium	790	66,000	ppb	21/27	15,867	ppb	a
	Copper	3,300	67,000,000	ppb	392/392	1,758,695	ppb	c
	Lead	2,600	13,000,000	ppb	397/397	399,287	ppb	c
	Selenium	100	2,900	ppb	169/392	443	ppb	b
	Silver	110	280,000	ppb	242/392	8,354	ppb	c
	Zinc	7,200	9,000,000	ppb	392/392	443,486	ppb	c
	Mercury	72	25,000	ppb	223/392	578	ppb	c
	Cyanide	1.1	4,200,000	ppb	171/394	113,190	ppb	c

Statistical Measure: Data was analyzed using U.S. EPA's ProUCL (v. 3, 2004), with ½ detection limits used for non-detects.

a. 95% H-UCL

b. 95% Chebyshev-UCL

97.5% Chebyshev-UCL

99% Chebyshev-UCL

# Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – All Soils

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> All Soils <b>Exposure Medium:</b> Outdoor Vapors from Soil			
Exposure Point	Chemical of Concern	Exposure Point Concentration	Exposure Point Concentration Units
Outdoor Soil Vapors On-Site  - Modeled Outdoor Vapor Inhalation for Industrial and Construction Worker	Chloroethane	1.75E-01	µg/m <sup>3</sup>
	1,1-Dichloroethane	1.47E-02	µg/m <sup>3</sup>
	1,2-Dichloroethane	8.47E-03	µg/m <sup>3</sup>
	1,1-Dichloroethene	3.10E-02	µg/m <sup>3</sup>
	cis-1,2-Dichloroethene	5.47E-01	µg/m <sup>3</sup>
	trans-1,2-Dichloroethene	2.14E-02	µg/m <sup>3</sup>
	1,1,2,2-Tetrachloroethane	4.86E-03	µg/m <sup>3</sup>
	Tetrachloroethene	2.94E-02	µg/m <sup>3</sup>
	1,1,1-Trichloroethane	1.75E-02	µg/m <sup>3</sup>
	1,1,2-Trichloroethane	5.57E-03	µg/m <sup>3</sup>
	Trichloroethene	2.07E+00	µg/m <sup>3</sup>
	Vinyl chloride	6.83E-02	µg/m <sup>3</sup>
	Arsenic	NA	µg/m <sup>3</sup>
	Barium	NA	µg/m <sup>3</sup>
	Cadmium	NA	µg/m <sup>3</sup>
	Chromium (III)	NA	µg/m <sup>3</sup>
	Hexavalent Chromium	NA	µg/m <sup>3</sup>
	Copper	NA	µg/m <sup>3</sup>
	Lead	NA	µg/m <sup>3</sup>
	Selenium	NA	µg/m <sup>3</sup>
	Silver	NA	µg/m <sup>3</sup>
	Zinc	NA	µg/m <sup>3</sup>
	Mercury	7.20E-04	µg/m <sup>3</sup>
	Cyanide	NA	µg/m <sup>3</sup>

Exposure Point Concentrations modeled using volatilization factor approach for outdoor vapors using all soil exposure concentrations.

# Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – Surface Soils

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> All Soils <b>Exposure Medium:</b> Indoor Vapors from Soil			
Exposure Point	Chemical of Concern	Exposure Point Concentration	Exposure Point Concentration Units
Indoor Soil	Chloroethane	2.1E+00	µg/m <sup>3</sup>
	Vapors On-Site		
- Modeled Indoor Soil Vapor Inhalation for Industrial Worker	1,1-Dichloroethane	2.4E-01	µg/m <sup>3</sup>
	1,2-Dichloroethane	4.3E-02	µg/m <sup>3</sup>
	1,1-Dichloroethene	1.0E+00	µg/m <sup>3</sup>
	cis-1,2-Dichloroethene	7.4E+00	µg/m <sup>3</sup>
	trans-1,2-Dichloroethene	4.6E-01	µg/m <sup>3</sup>
	1,1,2,2-Tetrachloroethane	1.3E-02	µg/m <sup>3</sup>
	Tetrachloroethene	6.1E-01	µg/m <sup>3</sup>
	1,1,1-Trichloroethane	4.2E-01	µg/m <sup>3</sup>
	1,1,2-Trichloroethane	2.8E-02	µg/m <sup>3</sup>
	Trichloroethene	33.9	µg/m <sup>3</sup>
	Vinyl chloride	2.4E+00	µg/m <sup>3</sup>
	Arsenic	NA	µg/m <sup>3</sup>
	Barium	NA	µg/m <sup>3</sup>
	Cadmium	NA	µg/m <sup>3</sup>
	Chromium (III)	NA	µg/m <sup>3</sup>
	Hexavalent Chromium	NA	µg/m <sup>3</sup>
	Copper	NA	µg/m <sup>3</sup>
	Lead	NA	µg/m <sup>3</sup>
	Selenium	NA	µg/m <sup>3</sup>
	Silver	NA	µg/m <sup>3</sup>
	Zinc	NA	µg/m <sup>3</sup>
	Mercury	7.5E-01	µg/m <sup>3</sup>
	Cyanide	NA	µg/m <sup>3</sup>

Exposure Point Concentrations modeled using Johnson & Ettinger Model for indoor vapors using all soil exposure concentrations.

# Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – Groundwater

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> All Groundwater <b>Exposure Medium:</b> Groundwater								
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Groundwater On-Site  - Ingestion for Industrial Worker	Chloroethane			ppb	0/42	0.50	ppb	
	1,1-Dichloroethane			ppb	0/42	0.50	ppb	
	1,2-Dichloroethane			ppb	0/42	0.50	ppb	
	1,1-Dichloroethene			ppb	0/42	0.50	ppb	
	cis-1,2-Dichloroethene	1.4	490	ppb	19/42	236.30	ppb	d
	trans-1,2-Dichloroethene	1.8	12	ppb	8/42	6.26	ppb	d
	1,1,2,2-Tetrachloroethane			ppb	0/42	0.50	ppb	
	Tetrachloroethene	1.7	9.4	ppb	5/42	1.92	ppb	b
	1,1,1-Trichloroethane	10.0	15	ppb	3/42	3.62	ppb	b
	1,1,2-Trichloroethane	1.0	2.3	ppb	5/42	0.78	ppb	g
	Trichloroethene	2.9	43,000	ppb	103/122	8853.81	ppb	d
	Vinyl chloride	1.6	1.6	ppb	1/42	0.57	ppb	g
	Arsenic	1.0	2.0	ppb	6/46	2.48	ppb	g
	Barium	20	170	ppb	46/46	102.13	ppb	b
	Cadmium	0.1	120	ppb	11/46	44.47	ppb	d
	Chromium (III)	0.7	1,200	ppb	32/46	340.90	ppb	d
	Hexavalent Chromium			ppb			ppb	
	Copper	2.0	410	ppb	45/46	55.41	ppb	b
	Lead	0.2	7.5	ppb	31/46	1.95	ppb	a
	Selenium	0.8	15	ppb	30/46	7.62	ppb	d
	Silver	0.1	0.3	ppb	9/46	0.12	ppb	g
	Zinc	1.0	27	ppb	37/46	12.20	ppb	b
	Mercury			ppb	0/46	0.10	ppb	
	Cyanide	8.0	360	ppb	12/46	52.55	ppb	b

Statistical Measure: Data was analyzed using U.S. EPA's ProUCL (v. 3, 2004), with ½ detection limits used for non-detects.

a. 95% H-UCL

b. 95% Chebyshev-UCL

d. 99% Chebyshev-UCL

g. 95% Students' t

Blank. No analysis needed, all the same values at ½ the detection limit.

## Summary of Chemicals of Concern and Medium Specific Exposure Concentrations – Groundwater

<b>Scenario Timeframe:</b> Current <b>Source Medium:</b> Groundwater <b>Exposure Medium:</b> Indoor Vapors from Groundwater			
Exposure Point	Chemical of Concern	Exposure Point Concentration	Exposure Point Concentration Units
Indoor Groundwater Vapors On-Site	Chloroethane	3.90E-04	µg/m <sup>3</sup>
	1,1-Dichloroethane	1.68E-04	µg/m <sup>3</sup>
- Modeled Indoor Groundwater Vapor Inhalation for Industrial Worker	1,2-Dichloroethane	2.90E-05	µg/m <sup>3</sup>
	1,1-Dichloroethene	9.12E-04	µg/m <sup>3</sup>
	cis-1,2-Dichloroethene	5.60E-02	µg/m <sup>3</sup>
	trans-1,2-Dichloroethene	3.57E-03	µg/m <sup>3</sup>
	1,1,2,2-Tetrachloroethane	8.01E-06	µg/m <sup>3</sup>
	Tetrachloroethene	1.68E-03	µg/m <sup>3</sup>
	1,1,1-Trichloroethane	3.59E-03	µg/m <sup>3</sup>
	1,1,2-Trichloroethane	3.55E-05	µg/m <sup>3</sup>
	Trichloroethene	4.94E+00	µg/m <sup>3</sup>
	Vinyl chloride	1.29E-03	µg/m <sup>3</sup>
	Arsenic	NA	µg/m <sup>3</sup>
	Barium	NA	µg/m <sup>3</sup>
	Cadmium	NA	µg/m <sup>3</sup>
	Chromium (III)	NA	µg/m <sup>3</sup>
	Hexavalent Chromium	NA	µg/m <sup>3</sup>
	Copper	NA	µg/m <sup>3</sup>
	Lead	NA	µg/m <sup>3</sup>
	Selenium	NA	µg/m <sup>3</sup>
	Silver	NA	µg/m <sup>3</sup>
	Zinc	NA	µg/m <sup>3</sup>
	Mercury	2.06E-05	µg/m <sup>3</sup>
	Cyanide	NA	µg/m <sup>3</sup>

Exposure Point Concentrations modeled using Johnson & Ettinger Model for indoor vapors using groundwater exposure concentrations.

## LA Darling Site - Baseline Conditions & Default Soil Parameters

### Carcinogenic Risks - Summary

Chemical	Industrial Worker							Construction Worker				
	Indoor Soil Vapor Inhalation	Indoor GW Vapor Inhalation	Outdoor Soil Vapor Inhalation	Outdoor Fugitive Dust Inhalation	Dermal Contact	Soil Ingestion	Total	Outdoor Soil Vapor Inhalation	Outdoor Fugitive Dust Inhalation	Dermal Contact	Soil Ingestion	Total
Chloroethane (ethyl chloride)	0E+00	0E+00	0E+00	0E+00	6E-11	1E-10	2E-10	0E+00	0E+00	2E-11	5E-11	7E-11
1,1-Dichloroethane	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
1,2-Dichloroethane	1E-07	8E-11	2E-08	2E-13	8E-10	2E-09	1E-07	1E-09	1E-14	1E-10	4E-10	2E-09
1,1-Dichloroethylene	5E-06	5E-09	2E-07	4E-13	0E+00	0E+00	5E-06	8E-09	2E-14	0E+00	0E+00	8E-09
cis-1,2-Dichloroethylene	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
trans-1,2-Dichloroethylene	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
1,1,2,2-Tetrachloroethane	8E-08	5E-11	3E-08	6E-13	2E-09	4E-09	1E-07	1E-09	3E-14	3E-10	1E-09	3E-09
Tetrachloroethylene	4E-08	1E-10	2E-09	3E-14	2E-09	5E-09	5E-08	8E-11	2E-15	1E-10	3E-10	5E-10
1,1,1-Trichloroethane	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
1,1,2-Trichloroethane	5E-08	6E-11	9E-09	1E-13	4E-10	9E-10	6E-08	4E-10	7E-15	6E-11	2E-10	7E-10
Trichloroethylene	6E-06	8E-07	4E-07	7E-12	7E-08	2E-07	7E-06	2E-08	3E-13	3E-09	1E-08	3E-08
Vinyl chloride (chloroethene)	2E-06	1E-09	6E-08	9E-14	2E-08	6E-08	2E-06	3E-09	5E-15	5E-09	2E-08	2E-08
Arsenic	0E+00	0E+00	0E+00	4E-09	7E-07	5E-06	6E-06	0E+00	2E-10	1E-07	1E-06	1E-06
Barium	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Cadmium	0E+00	0E+00	0E+00	2E-08	0E+00	0E+00	2E-08	0E+00	1E-09	0E+00	0E+00	1E-09
Chromium (III)	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Chromium (VI)	0E+00	0E+00	0E+00	7E-08	0E+00	0E+00	7E-08	0E+00	3E-09	0E+00	0E+00	3E-09
Copper	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Lead	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Selenium	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Silver	0E+00	0E+00	0E+00	0E+00	1E-08	2E-07	3E-07	0E+00	0E+00	1E-09	4E-08	4E-08
Zinc	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Mercury	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
Cyanide	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00	0E+00
TOTALS:	1E-05	9E-07	6E-07	1E-07	8E-07	6E-06	2E-05	3E-08	5E-09	1E-07	1E-06	2E-06

## LA Darling Site - Baseline Conditions & Default Soil Parameters

### Non-Carcinogenic Hazards - Summary

Chemical	Industrial Worker							Construction Worker				
	Indoor Soil Vapor Inhalation	Indoor GW Vapor Inhalation	Outdoor Soil Vapor Inhalation	Outdoor Fugitive Dust Inhalation	Dermal Contact	Soil Ingestion	Total	Outdoor Soil Vapor Inhalation	Outdoor Fugitive Dust Inhalation	Dermal Contact	Soil Ingestion	Total
Chloroethane (ethyl chloride)	6.89E-05	1.29E-08	5.78E-06	5.75E-12	5.27E-09	1.22E-08	7.47E-05	5.90E-06	5.87E-12	2.93E-08	9.77E-08	6.03E-06
1,1-Dichloroethane	1.59E-04	1.13E-07	9.84E-06	5.73E-11	3.88E-07	9.00E-07	1.70E-04	1.00E-05	5.84E-11	1.11E-06	3.69E-06	1.48E-05
1,2-Dichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,1-Dichloroethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E-05	1.22E-04	1.75E-04	0.00E+00	0.00E+00	1.64E-04	5.48E-04	7.12E-04
cis-1,2-Dichloroethylene	7.26E-02	5.53E-04	5.40E-03	8.26E-09	4.15E-05	9.63E-05	7.87E-02	5.51E-03	8.43E-09	5.41E-04	1.80E-03	7.86E-03
trans-1,2-Dichloroethylene	2.22E-03	1.71E-05	1.02E-04	4.95E-10	3.32E-06	7.69E-06	2.35E-03	1.04E-04	5.05E-10	1.05E-05	3.49E-05	1.50E-04
1,1,2,2-Tetrachloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tetrachloroethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-05	7.04E-05	1.01E-04	0.00E+00	0.00E+00	2.56E-05	8.53E-05	1.11E-04
1,1,1-Trichloroethane	1.42E-04	1.21E-06	5.87E-06	2.86E-11	2.11E-08	4.90E-08	1.49E-04	5.99E-06	2.92E-11	6.05E-08	2.02E-07	6.25E-06
1,1,2-Trichloroethane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-05	2.77E-05	3.96E-05	0.00E+00	0.00E+00	3.40E-05	1.13E-04	1.48E-04
Trichloroethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-02	3.13E-02	4.48E-02	0.00E+00	0.00E+00	1.37E-02	4.57E-02	5.94E-02
Vinyl chloride (chloroethene)	8.05E-03	4.32E-06	2.29E-04	3.54E-10	1.92E-05	4.45E-05	8.35E-03	2.34E-04	3.61E-10	7.92E-05	2.64E-04	5.77E-04
Arsenic	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.82E-03	4.50E-02	5.09E-02	0.00E+00	0.00E+00	2.01E-02	<b>2.23E-01</b>	<b>2.43E-01</b>
Barium	0.00E+00	0.00E+00	0.00E+00	7.81E-06	9.07E-05	2.10E-03	2.20E-03	0.00E+00	7.97E-06	2.15E-04	7.17E-03	7.39E-03
Cadmium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E-04	<b>1.62E-01</b>	<b>1.62E-01</b>	0.00E+00	0.00E+00	6.47E-03	<b>2.16E+00</b>	<b>2.16E+00</b>
Chromium (III)	0.00E+00	0.00E+00	0.00E+00	1.21E-05	6.57E-06	1.52E-04	1.71E-04	0.00E+00	1.24E-05	1.67E-04	5.58E-03	5.76E-03
Chromium (VI)	0.00E+00	0.00E+00	0.00E+00	2.47E-03	6.68E-04	1.55E-02	1.86E-02	0.00E+00	2.52E-03	3.20E-04	1.07E-02	1.35E-02
Copper	0.00E+00	0.00E+00	0.00E+00	8.23E-05	7.04E-04	1.63E-02	1.71E-02	0.00E+00	8.40E-05	4.48E-03	<b>1.49E-01</b>	<b>1.54E-01</b>
Lead	0.00E+00	0.00E+00	0.00E+00	4.68E-05	0.00E+00	0.00E+00	4.68E-05	0.00E+00	4.77E-05	0.00E+00	0.00E+00	4.77E-05
Selenium	0.00E+00	0.00E+00	0.00E+00	9.17E-08	5.96E-06	1.38E-04	1.44E-04	0.00E+00	9.36E-08	8.57E-06	2.86E-04	2.94E-04
Silver	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zinc	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.41E-05	1.95E-03	2.04E-03	0.00E+00	0.00E+00	1.30E-04	4.34E-03	4.47E-03
Mercury	<b>8.36E-01</b>	2.30E-05	8.05E-04	1.27E-06	2.06E-04	4.78E-03	<b>8.42E-01</b>	8.22E-04	1.29E-06	1.87E-04	6.22E-03	7.23E-03
Cyanide	0.00E+00	0.00E+00	0.00E+00	8.75E-08	0.00E+00	3.06E-03	3.06E-03	0.00E+00	8.93E-08	0.00E+00	6.77E-02	6.77E-02
<b>TOTALS:</b>	<b>0.9</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.3</b>	<b>1.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>2.7</b>	<b>2.7</b>

# SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs FOR SOIL

Description	Prerequisite for ARAR	Requirement	Citation	Comments
<b>State Requirement</b>				
Determination of cleanup criteria	Facility requiring remedial action	Cleanup category requirements and remedial action criteria	NREPA, Part 201 (1994 PA 451, as amended), Section 20120(a)	Soil cleanup level may be applicable.
		Land-use requirements for facilities that do not meet residential cleanup goals	NREPA, Part 201 (1994 PA 451, as amended), Section 20120(b)	

## Notes

ARAR = Applicable or relevant and appropriate requirement  
 40 CFR = Title 40 of the *Code of Federal Regulations*  
 NREPA = Natural Resources and Environmental Protection Act  
 PA = Public Act  
 PCB = Polychlorinated Biphenyls

## SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs FOR GROUNDWATER

Description	Prerequisite for ARAR	Requirement	Citation	Comments
<b>Federal Requirements</b>				
MCLs	Actual or potential drinking water source	Ensure that chemical constituents do not exceed water quality standards	Safe Drinking Water Act: 42 USC, 300, Subchapter XII; 40 CFR, Part 141	MCLs would be relevant and appropriate if groundwater around the site is used or potentially used for drinking water or designated for public or private waste use.
Water quality criteria	Discharge to surface water used by aquatic organisms and humans; human consumption of aquatic organisms	Surface water must not exceed numerical criteria for certain indicator chemicals and other water quality-related standards	Clean Water Act: 33 USC 1251	May be relevant and appropriate if contaminated groundwater discharges to surface water
<b>State Requirements</b>				
Drinking water source	Groundwater used or potentially used for drinking water	Acceptable concentrations of chemical constituents in groundwater must not exceed water quality standards	Michigan Safe Drinking Water Act (PA 399)	May be applicable if promulgated water quality standards are more stringent than federal MCLs
Groundwater discharge to surface water	Groundwater cleanup desired	Ensure that chemical constituents do not exceed water quality standards	NREPA Part 31 Water Resources Protection (Parts 4 and 8 and Rules)	May be relevant and appropriate if groundwater discharges to surface water
Groundwater quality	Groundwater cleanup desired	Cleanup category requirements and remedial action criteria	NREPA, Part 201, Section 20120(a) (1994 PA 451, as amended)	Groundwater cleanup levels may be applicable
		Land-use requirements for facilities that do not meet residential cleanup goals	NREPA, Part 201, Section 20120(b) (1994 PA 451, as amended)	Groundwater cleanup levels may be applicable
		Protection of public health and welfare and to maintain quality of groundwater in all usable aquifers used for individual, public, industrial, and agricultural water supply, and provide for the nondegradation of groundwater in usable aquifers	NREPA, Part 31 (1994 PA 451, as amended), Part 22 Rules, Groundwater Quality	May be applicable if promulgated water quality standards are more stringent than federal MCLs

### Notes.

ARAR = Applicable or relevant and appropriate requirement  
 40 CFR = Title 40 of the *Code of Federal Regulations*  
 MCL = Maximum Containment Level  
 NREPA = National Resources and Environmental Protection Act  
 PA = Public Act  
 USC = *United States Code*

## SUMMARY OF POTENTIAL ACTION-SPECIFIC ARARs FOR SOIL

Description	Prerequisite for ARAR	Requirement	Citation	Comments
<b>Federal Requirements</b>				
Excavation	Fugitive dust emissions from excavation activities	Control activity to minimize particulate matter emissions	40 CFR, Part 51	May be applicable to alternatives involving extraction
Closure in place (capping)	Disposal of nonhazardous solid waste in land disposal unit	Minimum design and operation criteria for land disposal of solid wastes to minimize infiltration of precipitation, erosion, and odors, and to be aesthetically pleasing	40 CFR, Part 240.208	May be relevant and appropriate to capping
New air emissions sources	On-site incinerator, air stripper, or soil treatment units; establishes air emissions limits based on modeling	NAAQS specify the maximum concentrations of federally regulated air pollutants (such as SO <sub>2</sub> , particulate matter [PM 10], NO <sub>2</sub> , CO, ozone, and lead) in an area resulting from all sources of these pollutants; no new construction or modification of facility, structure, or installation may emit an amount of any criteria pollutant that will interfere with the attainment or maintenance of an NAAQS (see 40 CFR, Part 51.60)	Federal Clean Air Act: 42 USC 7401; 40 CFR, Part 50 (NAAQS regulations)	May be applicable to treatment units with regulated emission levels
<b>State Requirements</b>				
Excavation	Maintenance or undertaking of a land use or earth change	Provide for control of soil erosion and prevent sedimentation of surface water	NREPA, Part 91(1994 PA 451, as amended), Soil Erosion and Sedimentation Control	Maybe applicable to alternatives involving excavation
	Excavation of contaminated soil	Provide for control of fugitive dust or air emissions that would affect human health and the environment	NREPA, Part 55 (1994 PA 451, as amended), Air Pollution Control	May be applicable to alternatives involving excavation
	Excavation of contaminated soil	Requirements for characterization and handling of hazardous waste	NREPA, Part 111 (1994 PA 451, as amended), Hazardous Waste Management	May be applicable to alternatives involving excavation.
On-site waste piles storage	Storage of nonhazardous waste in on-site piles	Characterize nature of wastes to be accumulated in piles	NREPA, Part 115 (1994 PA 451, as amended), Solid Waste Management	May be applicable to alternatives involving on-site storage of soil

Table 5

Description	Prerequisite for ARAR	Requirement	Citation	Comments
On-site relocation of soil	Relocation of excavated soil	Requirements for relocation of excavated soil	NREPA, Part 201, Section 20120(c) (1994 PA 451, as amended)	May be applicable to alternatives involving on-site disposal of excavated soil
Off-site disposal of soil	Disposal of excavated soils at a RCRA hazardous or nonhazardous waste landfill	Requirements for relocation of excavated soil	NREPA, Part 201, Section 20120(c) (1994 PA 451, as amended)	May be applicable to alternatives involving on-site disposal of excavated soil
Transport of heavy materials or equipment	Transport of excavated soil and equipment	Requirements for maximum axle loads during frost periods	Michigan Vehicle Code (PA 300), Section 257.722	May be applicable to transport of excavated soils and heavy equipment
Closure in place (capping)	Disposal of nonhazardous waste in land disposal units	Final covers minimum of 2 feet of compacted soil to specification	NREPA, Part 115, Section 11523a (1994 PA 451, as amended), Solid Waste Management	Capping requirements may be relevant and appropriate for containment alternatives
	Containment of wastes on site	Provide for control of fugitive dust or air emissions that would affect human health and the environment	NREPA, Part 55, (1994 PA 451, as amended), Soil Erosion and Sedimentation Control	May be applicable to alternatives involving excavation
		Implement soil erosion and sediment control procedures	NREPA, Part 91 (1994 PA 451, as amended), Soil Erosion and Sedimentation Control	May be applicable to capping alternatives
Sedimentation of surface water	Earth changing activities more than 1 acre in area or within 500 feet of a lake or stream	Implement appropriate erosion and sedimentation control measures	NREPA, Part 91 (1994 PA 451, as amended), Soil Erosion and Sedimentation Control	May be applicable to excavation alternatives

Notes:

ARAR = Applicable or relevant and appropriate requirement  
 CO = Carbon monoxide  
 40 CFR = Title 40 of the *Code of Federal Regulations*  
 NAAQS = National Ambient Air Quality Standards (primary and secondary)  
 NO<sub>2</sub> = Nitrogen dioxide  
 PA = Public Act  
 RCRA = Resource Conservation and Recovery Act  
 SO<sub>2</sub> = Sulfur dioxide  
 USC = *United States Code*

## SUMMARY OF POTENTIAL ACTION-SPECIFIC ARARs FOR GROUNDWATER

Description	Prerequisite for ARAR	Requirement	Citation	Comments
<b>Federal Requirements</b>				
New air emissions sources	On-site incinerator, air stripper, or soil treatment units; establishes limits for air emissions based on modeling	NAAQS specify the maximum concentrations of federally regulated air pollutants (such as SO <sub>2</sub> , particulate matter [PM <sub>10</sub> ], NO <sub>2</sub> , CO, ozone, and lead) in an area resulting from all sources of these pollutants; no new construction or modification of facility, structure, or installation may emit an amount of any criteria pollutant that will interfere with the attainment or maintenance of a NAAQS (see 40 CFR, Part 51.60)	Federal Clean Air Act 42 USC 7401; 40 CFR, Part 50; NAAQS regulations	May be applicable to treatment units with regulated emission levels
Point-source discharge to surface water	Surface water discharge of treated effluent	Applicable federal water quality criteria for the protection of aquatic life must be complied with when environmental factors are being considered	CWA, 40 CFR, Part 122.44	May be applicable to discharge of treated groundwater to surface water
		Applicable federally approved state water quality standards must be complied with; standards may be in addition to or more stringent than other federal standards under CWA		
		Discharge must be consistent with the requirements of the state's Water Quality Management Plan approved by EPA	CWA, Section 208(b)	May be applicable to discharge of treated groundwater to surface water
Point-source discharge to surface water (continued)	Surface water discharge affecting waters outside of the state	Use of economically achievable BAT is required to control toxic and nonconventional pollutants; use of best conventional pollutant control technology is required to control conventional pollutants; technology-based limitations may be determined on case-by-case basis	40 CFR, Part 122.44(a)	May be applicable to discharge of treated groundwater to surface water
		Discharge must conform to applicable water quality requirements when discharge affects state other than the certifying state	40 CFR, Part 122.44(e)	May be applicable to discharge of treated groundwater to surface water

Description	Prerequisite for ARAR	Requirement	Citation	Comments
	Surface water discharge of treated effluent	<p>Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than those that can be achieved by technology-based standards</p> <p>Comply with additional substantive requirements such as the following:</p> <ul style="list-style-type: none"> <li>• Duty to mitigate any adverse effects on any discharge</li> <li>• Proper operation and maintenance of treatment systems</li> </ul>	<p>40 CFR, Part 122.44(e)</p> <p>40 CFR, Part 122.41(d); 40 CFR, Part 122.41(e)</p>	<p>May be applicable to discharge of treated groundwater to surface water</p> <p>May be applicable to the discharge of treated groundwater to surface water</p>
Point-source discharge to surface water (continued)	Surface water discharge	<p>Develop and implement a BMP program and incorporate measures that prevent the release of toxic constituents to surface waters; BMP program must do the following:</p> <ul style="list-style-type: none"> <li>• Establish specific procedures for the control of toxic and hazardous pollutant spills</li> <li>• Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure</li> <li>• Ensure proper management of solid and hazardous waste in accordance with RCRA regulations</li> </ul>	40 CFR, Parts 122.44(k)	May be applicable to discharge of treated groundwater to surface water
On-site treatment	Waste treatment unit generating air emissions	Control of air emissions from the treatment unit	40 CFR, Part 61	May be applicable or relevant and appropriate
State Requirements				

Description	Prerequisite for ARAR	Requirement	Citation	Comments
Point-source discharge to surface water	Discharge of treated effluent to surface water	Comply with Part 31 requirements to protect waters of the state and Great Lakes	NREPA, Part 31 (1994 PA 451, as amended)	May be applicable to discharge of treated groundwater to surface water
On-site treatment	Operation of an air stripper as part of the groundwater remedies	Comply with air emission standards	NREPA, Part 55 (1994 PA 451, as amended), Air Pollution Control	May be applicable to alternatives involving operation of an air stripper
Installation of monitoring wells	Installation of monitoring wells as part of the groundwater remedies	Requirements for permitting of drilling associated with monitoring well installation	NREPA, Part 624 (1994 PA 451, as amended) Mineral Well Act	May be applicable to installation of monitoring wells as part of the groundwater remedies
Transport of heavy materials or equipment	Transport of heavy materials and equipment	Requirements for maximum axle loads during frost periods	Michigan Vehicle Code, PA 300, Section 257.722	May be applicable to transport of heavy materials and equipment
On-site treatment	Construction of groundwater treatment system	Implement soil erosion and sediment control procedures	NREPA, Part 91 (1994 PA 451, as amended), Soil Erosion and Sedimentation Control	May be applicable to construction of an on-site groundwater treatment unit
	Construction and operation of groundwater treatment system	Requirements for characterization and handling of hazardous waste	NREPA, Part 111 (1994 PA 451, as amended), Hazardous Waste Management	May be applicable to construction and operation of an on-site treatment unit
Point source discharge to surface water	Discharge of treated effluent to surface water	Prohibits direct or indirect discharge to ground or surface waters of the state that are or may become injurious to the environment or public health	NREPA, Part 31, Section 3109 (1994 PA 451, as amended)	May be applicable to discharge of treated groundwater to surface water
Unpalatable flavor of food or fish; interference with surface water use	Taste and odor tainting of surface water	Prevent concentrations in surface water of taste- and odor-producing substances	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
Acute toxicity of discharges	Acutely toxic surface water	Prevent acutely toxic substances from entering surface water	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
Chronic toxicity of discharges	Chronically toxic surface water	Prevent chronically toxic substances from entering surface water	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
Generally toxicity of discharges	Generally toxic surface water	Prevent generally toxic substances from entering surface water	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water

Description	Prerequisite for ARAR	Requirement	Citation	Comments
Human toxicity of discharges	Surface water toxic to humans	Prevent substances toxic to humans from entering surface water	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
LC50 toxicity criteria of discharges	Exposure of aquatic organisms to toxic concentrations at LC50 doses	Prevent toxic concentrations of substances based on LC50 doses	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
Numeric criteria for toxics	Toxic materials and site indicator chemicals with numeric criteria	Discharge cannot exceed numeric criteria	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
Antidegradation standard	Water quality of discharge must meet water quality standards of receiving water	Avoid degradation of waters with lower water quality standards	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water
Disposal of solid wastes from groundwater remedies	Groundwater remedies that generate solid waste	Characterization and handling of wastes generated from groundwater treatment	NREPA, Part 115 (1994 PA 451, as amended), Solid Waste Management	May be applicable to alternatives involving groundwater treatment
Site-specific designated uses and criteria	Wastewater discharge to surface water	Designated uses of surface water must be provided	NREPA, Part 31 (1994 PA 451, as amended), Water Resources Protection	May be applicable to discharge of treated groundwater to surface water

#### Notes

ARAR	=	Applicable or relevant and appropriate requirement
BAT	=	Best available technology
BMP	=	Best management practice
CO	=	Carbon monoxide
40 CFR	=	Title 40 of the <i>Code of Federal Regulations</i>
CWA	=	Clean Water Act
EPA	=	U.S. Environmental Protection Agency
LC50	=	Lethal concentration to 50 percent of exposed organisms
NAAQS	=	National Ambient Air Quality Standards (primary and secondary)
NO <sub>2</sub>	=	Nitrogen dioxide
NREPA	=	National Resources and Environmental Protection Act
PA	=	Public Act
RCRA	=	Resource Conservation and Recovery Act
SO <sub>2</sub>	=	Sulfur dioxide
USC	=	<i>United States Code</i>

## SUMMARY OF POTENTIAL ACTION-SPECIFIC ARARs

Description	Prerequisite for ARAR	Requirement	Citation	Comments
<b>Federal Requirement</b>				
Demolition	Fugitive dust emissions from demolition activities	Control activity of minimize particulate matter emissions	40 CFR, Part 51	May be applicable to alternatives involving building demolition
<b>State Requirements</b>				
Demolition	Maintenance or undertaking of a land use or earth change	Provide for control of soil erosion and prevent sedimentation of surface water	NREPA, Part 91 (1994 PA 451, as amended), Soil Erosion and Sedimentation Control	May be applicable to alternatives involving demolition
	Demolition of contaminated building	Provide for control of fugitive dust or air emissions that would affect human health and the environment	NREPA, Part 55 (1994 PA 451, as amended), Air Pollution Control	May be applicable to alternatives involving demolition
	Demolition of contaminated building	Requirements for characterization and handling of hazardous waste	NREPA, Part 111 (1994 PA 451, as amended), Hazardous Waste Management and R 299.9301 of the Michigan Administrative Code	May be applicable to alternatives involving demolition
Off-site disposal of demolition debris	Disposal of building debris at a RCRA hazardous or nonhazardous waste landfill	Requirements for relocation of excavated soil	NREPA, Part 201, Section 20120(c) (1994 PA 451, as amended)	May be applicable to alternatives involving off-site disposal of building debris
Transport of heavy materials or equipment	Transport of excavated soils and equipment	Requirements for maximum axle loads during frost periods	Michigan Vehicle Code (PA 300), Section 257.722	May be applicable to transport of building debris and heavy equipment
Sedimentation of surface waters	Earth changing activities more than 1 acre in area or within 500 feet of a lake or stream	Implement appropriate erosion and sedimentation control measures	NREPA, Part 91 (1994 PA 451, as amended), Soil Erosion and Sedimentation Control	May be applicable to demolition alternatives

Notes

ARAR	=	Applicable or relevant and appropriate requirement
NREPA	=	Natural Resources and Environmental Protection Act
PA	=	Public Act
40 CFR	=	Title 40 of the <i>Code of Federal Regulations</i>
RCRA	=	Resource Conservation and Recovery Act

## SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARs

Location	Prerequisite for ARAR	Requirement	Citation	Comments
<b>Federal Requirements</b>				
Within flood plain	Action in lowlands, relatively flat areas adjoining inland and coastal waters, or other flood-prone areas	Avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values	Executive Order on Floodplain Management: Exec. Order No. 11,988; 40 CFR, Part 6.302(b), and Appendix A	May be applicable if remedial action planned within flood plain
Critical habitat upon which endangered or threatened species depends	Determination of endangered or threatened species	Conserve endangered or threatened species in consultation with the U.S. Department of the Interior	Endangered Species Act (16 USC 1531 et. seq.); 50 CFR, Part 17; 50 CFR, Part 402	May be ARAR if endangered or threatened species exist on site
Within coastal zone	Conduct activities in manner consistent with approved state coastal zone management program	Activities affecting coastal zone, including lands thereunder and adjacent shorelands	Coastal Zone Management Act (16 USC, Section 1451 et. seq.) 15 CFR, Part 923.3	May be ARAR because site surface water has direct access to coastal management zone of Lake Michigan
<b>State Requirement</b>				
Within a 100-year flood plain	Occupation, filling, or grading of lands in a flood plain	Submit permit application to MDEQ containing, if requested, site development plan, river cross section, and hydraulic report	NREPA, Part 31 (1994 PA 451, as amended);	May be applicable if construction activities conducted in 100-year flood plain

**Notes:**

ARAR            Applicable or relevant and appropriate requirement  
 15 CFR        Title 15 of the *Code of Federal Regulations*  
 40 CFR        =    Title 40 of the *Code of Federal Regulations*  
 50 CFR        =    Title 50 of the *Code of Federal Regulations*  
 MDEQ        =    Michigan Department of Environmental Quality  
 PA             =    Public Act  
 USC           =    *United States Code*

Remedial Action Alternative	Description	TABLE 7 – Summary of Nine Criteria Evaluation								
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of TMV through Treatment	Short-term Effectiveness	Implementability	Cost	State Acceptance	Community Acceptance
No Action Soil Alternative	No action taken to address site risks.	Not protective.	Does not comply with ARARs.	Not effective.	No treatment utilized.	Not effective in the short-term.	Implementable.	\$0	Not acceptable.	Not acceptable.
Soil Action Alternative 1	Excavation and removal of contaminated soil and structures.	Provides protection to human health and the environment use restrictions below water table are followed.	Can be designed to meet state and federal ARARs.	Provides for long-term effectiveness and permanence through removal of soil and restriction of activities below water table.	No treatment utilized.	Excavation can be completed in a relatively short time-frame. Implementation risks are controllable.	Easily implementable.	\$623,566	Under review.	Acceptable.
Soil Action Alternative 2	In-Situ Chemical Oxidation of Metals and Some Inorganics. Cover over remaining material.	Provides protection to human health and the environment if cover is maintained and use restrictions below water table are followed.	Can be designed to meet state and federal ARARs.	Provides for some permanence through soil treatment, but relies on cover maintenance and deed restrictions to ensure effectiveness of remedy.	Provides for treatment of metals and some VOCs through in-situ oxidation.	Chemical oxidation can be completed in a relatively short time-frame, but an extended design phase may be required. Implementation risks are controllable.	Can be implemented, but design will require a detailed review and cover system would need to meet MDEQ ARARs appropriate for residual contamination.	\$1,092,270	Under review.	Received no input on alternative during public comment.
Soil Action Alternative 3	In-situ SVE of VOCs. Soil cover over remaining material.	Provides protection to human health and the environment if cover is maintained and use restrictions below the water table are followed.	Can be designed to meet state and federal ARARs.	Provides for some permanence through soil treatment, but relies on cover maintenance and deed restrictions to ensure effectiveness of remedy.	Provides for removal of VOCs through SVE. Treatment component would depend on how vapor phase contamination is addressed.	SVE system can be put into operation in a relatively short period of time, but an extended design phase may be required. The period of SVE operational could be many years. Implementation risks are controllable.	Can be implemented, but design will require a detailed review and cover system would need to meet MDEQ ARARs appropriate for residual contamination	\$808,680	Under review.	Received no input on alternative during public comment.
No Action Groundwater Alternative	No action taken to address site risks.	Not protective.	Does not comply with ARARs.	Not effective.	No treatment utilized.	Not effective in the short-term.	Implementable.	\$0	Not acceptable.	Not acceptable.
Groundwater Action Alternative 1	Phase 1: Air sparging with SVE. Phase 2: Groundwater Extraction and treatment.	Provides adequate protection until a final ROD for NBFF groundwater is signed.	Can be designed to meet state and federal ARARs regarding system operation. Cleanup standards will be set in final NBFF groundwater ROD.	Permanent removal of contamination from aquifer will require long-term operation of the system. Effective interim remedy if use restrictions are enforced.	Reduction of TMV would depend on the vapor and water treatment approaches developed during remedial design.	Effective in the short-term by limiting access to water use at the facility. Would commence long-term process of source removal. Implementation risks are controllable.	Can be implemented, but system will require careful monitoring.	\$1,371,000	Under review.	Acceptable.
Groundwater Action Alternative 2	Groundwater extraction and treatment using GAC, chemical precipitation.	Provides adequate protection until a final ROD for NBFF groundwater is signed.	Can be designed to meet state and federal ARARs regarding system operation. Cleanup standards will be set in final NBFF groundwater ROD.	Permanent removal of contamination from aquifer will require long-term operation of the system. Effective interim remedy if use restrictions are enforced.	Reduction of TMV would depend on the vapor and water treatment approaches developed during remedial design.	Effective in the short-term by limiting access to water use at the facility. Would commence long-term process of source removal. Implementation risks are controllable, but use of ozone could be problematic.	Can easily be implemented.	\$2,053,000	Under review.	Received no input on alternative during public comment.
Groundwater Action Alternative 3	Groundwater extraction and treatment using ozone, GAC, chemical precipitation.	Provides adequate protection until a final ROD for NBFF groundwater is signed.	Can be designed to meet state and federal ARARs regarding system operation. Cleanup standards will be set in final NBFF groundwater ROD.	Permanent removal of contamination from aquifer will require long-term operation of the system. Effective interim remedy if use restrictions are enforced.	Reduction of TMV would depend on the vapor and water treatment approaches developed during remedial design.	Effective in the short-term by limiting access to water use at the facility. Would commence long-term process of source removal. Implementation risks are controllable.	Can be implemented, but system will require careful monitoring.	\$1,463,695	Under review.	Received no input on alternative during public comment.



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

All criteria, unless otherwise noted, are expressed in units of parts per billion (ppb). One ppb is equivalent to one microgram per kilogram (ug/kg). Criteria with six or more digits are expressed in scientific notation. For example, 200,000 ppb is presented as 2.0E+5. A footnote is designated by a letter in parentheses and is explained in the footnote pages that follow the criteria tables. When the risk-based criterion is less than the target detection limit (TDL), the TDL is listed as the criterion (R 299.5707). In these cases, two numbers are presented in the cell. The first number is the criterion (i.e., TDL), and the second number is the risk-based value. Criteria were promulgated December 21, 2002 within the Administrative Rules for Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. These tables reflect modifications to the TDLs and new criteria consistent with the provisions of R299.5103(l) and R299.5706a, respectively.

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
#10			#21	#12	#13	#22		#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Acenaphthene	83329	NA	3.0E+5	8.8E+5	4,400	9.7E+5	3.5E+8	9.7E+7	9.7E+7	9.7E+7	6.2E+9	1.3E+8	1.8E+8	1.5E+8	NA
Acenaphthylene	208968	NA	5,900	17,000	ID	4.4E+5	3.0E+6	2.7E+6	2.7E+6	2.7E+6	1.0E+9	5.2E+6	7.2E+6	6.1E+6	NA
Acetaldehyde (I)	75070	NA	19,000	54,000	2,600	1.1E+8 (C)	4.0E+5	2.1E+5	2.1E+5	2.9E+5	2.6E+8	9.5E+7	1.1E+8 (C)	1.1E+8	1.1E+8
Acetate	71501	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID	ID
Acetic acid	64197	NA	84,000	2.4E+5	3.6E+5	6.5E+8 (C)	NLV	NLV	NLV	NLV	7.4E+9	4.2E+8	5.8E+8	4.9E+8	6.5E+8
Acetone (I)	67641	NA	15,000	42,000	34,000	1.1E+8 (C)	1.1E+8 (C)	1.6E+8	1.6E+8	2.0E+8	1.7E+11	7.3E+7	1.0E+8	8.6E+7	1.1E+8
Acetonitrile	75058	NA	2,800	8,000	NA	2.2E+7 (C)	8.8E+6	1.9E+6	1.9E+6	2.2E+6	1.8E+9	1.4E+7	1.9E+7	1.6E+7	
Acetophenone	98862	NA	30,000	88,000	NA	1.1E+6 (C)	1.1E+6 (C)	5.2E+7	5.2E+7	5.2E+7	1.4E+10	1.1E+6 (C)	1.1E+6 (C)	1.1E+6 (C)	
Acrolein (I)	107028	NA	2,400	6,600	NA	2.3E+7 (C)	760	370	370	630	5.9E+5	1.2E+7	1.6E+7	1.4E+7	
Acrylamide	79061	NA	10	10	NA	2.6E+5	NLV	NLV	NLV	NLV	3.0E+6	8,700	12,000	10,000	
Acrylic acid	79107	NA	78,000	2.2E+5	NA	1.1E+8 (C)	5.5E+6	2.2E+5	2.7E+5	2.7E+5	2.9E+7	1.1E+8 (C,DD)	1.1E+8 (C,DD)	1.1E+8 (C,DD)	
Acrylonitrile (I)	107131	NA	100 (M); 52	220	100 (M,X); 98	2.8E+5	35,000	17,000	17,000	31,000	5.8E+7	74,000	1.0E+5	87,000	
Alachlor	15972608	NA	52	52	290 (X)	44,000	NLV	NLV	NLV	NLV	ID	3.9E+5	6.9E+5	5.1E+5	
Aldicarb	116063	NA	60	60	NA	2.4E+6	NLV	NLV	NLV	NLV	ID	7.3E+5	1.0E+6	8.6E+5	
Aldicarb sulfoxide	1646873	NA	200 (M)	200 (M)	NA	5.4E+7	NLV	NLV	NLV	NLV	ID	9.5E+5	1.3E+6	1.1E+6	
Aldicarb sulfone	1646884	NA	200 (M); 40	200 (M); 40	NA	4.2E+7	NLV	NLV	NLV	NLV	ID	8.0E+5	1.1E+6	9.4E+5	
Aldrin	309002	NA	NLL	NLL	NLL	NLL	7.1E+6	2.0E+5	2.0E+5	2.0E+5	8.0E+5	4,300	7,700	5,600	
Aluminum (B)	7429905	6.9E+6	1,000	1,000	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	3.7E+8 (DD)	4.1E+8 (DD)	3.9E+8 (DD)	
Ammonia	7664417	NA	ID	ID	(CC)	ID	ID	ID	ID	ID	2.9E+9	ID	ID	ID	

Table 8



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
Guidesheet Number →		#10	#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
t-Amyl methyl ether (TAME)	994058	NA	3,900	3,900	NA	4.4E+5 (C)	1.1E+5	4.0E+5	7.8E+5	1.8E+6	1.8E+9	4.4E+5 (C)	4.4E+5 (C)	4.4E+5 (C)	4.4E+5
Aniline	62533	NA	1,100	4,400	330 (M); 80	2.8E+6	NLV	NLV	NLV	NLV	2.9E+7	1.5E+6	2.1E+6	1.8E+6	4.5E+6
Anthracene	120127	NA	41,000	41,000	ID	41,000	1.0E+9 (D)	1.6E+9	1.6E+9	1.6E+9	2.9E+10	7.3E+8	1.0E+9	8.6E+8	NA
Antimony	7440360	NA	4,300	4,300	94,000	4.9E+7	NLV	NLV	NLV	NLV	5.9E+6	6.7E+5	7.3E+5	7.0E+5	NA
Arsenic	7440382	5,800	4,600	4,600	70,000 (X)	2.0E+6	NLV	NLV	NLV	NLV	9.1E+5	37,000	46,000	41,000	NA
Asbestos (BB)	1332214	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	1.0E+7 (M); 85,000	ID	ID	ID	NA
Atrazine	1912249	NA	60	60	150 (X)	1.1E+5	NLV	NLV	NLV	NLV	ID	3.3E+5 (DD)	4.6E+5 (DD)	3.9E+5 (DD)	NA
Azobenzene	103333	NA	4,200	17,000	NA	3.0E+5	3.2E+7	2.1E+6	ID	ID	1.3E+8	6.6E+5	9.2E+5	7.7E+5	NA
Barium (B)	7440393	75,000	1.3E+6	1.3E+6	(G,X)	1.0E+9 (D)	NLV	NLV	NLV	NLV	1.5E+8	1.3E+8	1.5E+8	1.4E+8	NA
Benzene (I)	71432	NA	100	100	4,000 (X)	2.2E+5	8,400	45,000	99,000	2.3E+5	4.7E+8	4.0E+5 (C)	4.0E+5 (C)	4.0E+5 (C)	4.0E+5
Benidine	92875	NA	1,000 (M); 6.0	1,000 (M); 6.0	ID	1,000 (M); 140	NLV	NLV	NLV	NLV	59,000	1,000 (M); 110	1,000 (M); 150	1,000 (M); 120	NA
Benzo(a)anthracene (Q)	56553	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	80,000	1.6E+5	1.1E+5	NA
Benzo(b)fluoranthene (Q)	205992	NA	NLL	NLL	NLL	NLL	ID	ID	ID	ID	ID	80,000	1.6E+5	1.1E+5	NA
Benzo(k)fluoranthene (Q)	207089	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	8.0E+5	1.6E+6	1.1E+6	NA
Benzo(g,h,i)perylene	191242	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	3.5E+8	7.0E+6	1.4E+7	9.5E+6	NA
Benzo(a)pyrene (Q)	50328	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	1.9E+6	8,000	16,000	11,000	NA
Benzoic acid	65850	NA	6.4E+5	1.8E+6	NA	7.0E+7	NLV	NLV	NLV	NLV	ID	1.0E+9 (D)	1.0E+9 (D)	1.0E+9 (D)	NA
Benzyl alcohol	100516	NA	2.0E+5	5.8E+5	NA	5.8E+6 (C)	NLV	NLV	NLV	NLV	1.5E+11	5.8E+6 (C)	5.8E+6 (C)	5.8E+6 (C)	5.8E+6
Benzyl chloride	100447	NA	150	640	NA	72,000	33,000	48,000	48,000	52,000	7.8E+7	2.2E+5	2.3E+5 (C)	2.3E+5 (C)	2.3E+5
Beryllium	7440417	NA	51,000	51,000	(G)	1.0E+9 (D)	NLV	NLV	NLV	NLV	5.9E+5	1.6E+6	1.6E+6	1.6E+6	NA
bis(2-Chloroethoxy)ethane	112265	NA	ID	ID	ID	ID	NLV	NLV	NLV	NLV	ID	ID	ID	ID	2.7E+6
bis(2-Chloroethyl)ether (I)	111444	NA	100	170	300	1.1E+5	44,000	13,000	13,000	13,000	1.2E+7	58,000	81,000	68,000	2.2E+6
bis(2-Ethylhexyl)phthalate	117817	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	8.9E+8	1.0E+7 (C)	1.0E+7 (C)	1.0E+7 (C)	1.0E+7
Boron (B)	7440428	NA	10,000	10,000	38,000	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	3.5E+8 (DD)	3.9E+8 (DD)	3.7E+8 (DD)	NA



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
#10			#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Bromate	15541454	NA	200	200	800	96,000	NLV	NLV	NLV	NLV	ID	91,000	99,000	95,000	NA
Bromobenzene (I)	108861	NA	550	1,500	NA	3.6E+5	5.8E+5	5.4E+5	5.4E+5	5.4E+5	2.4E+8	7.6E+5 (C)	7.6E+5 (C)	7.6E+5 (C)	7.6E+5
Bromodichloromethane	75274	NA	1,600 (W)	1,600 (W)	ID	2.8E+5	6,400	31,000	31,000	57,000	1.1E+8	4.9E+5	6.8E+5	5.7E+5	1.5E+6
Bromoform	75252	NA	1,600 (W)	1,600 (W)	ID	8.7E+5 (C)	7.7E+5	3.1E+6	3.1E+6	3.1E+6	3.6E+9	8.7E+5 (C)	8.7E+5 (C)	8.7E+5 (C)	8.7E+5
Bromomethane	74839	NA	200	580	700	1.4E+6	1,600	13,000	57,000	1.4E+5	1.5E+8	1.0E+6	1.4E+6	1.2E+6	2.2E+6
n-Butanol (I)	71363	NA	19,000	54,000	NA	8.7E+6 (C)	NLV	NLV	NLV	NLV	1.0E+10	8.7E+6 (C)	8.7E+6 (C)	8.7E+6 (C)	8.7E+6
2-Butanone (MEK) (I)	78933	NA	2.6E+5	7.6E+5	44,000	2.7E+7 (C)	2.7E+7 (C)	3.5E+7	3.5E+7	3.6E+7	2.9E+10	2.7E+7 (C,DD)	2.7E+7 (C,DD)	2.7E+7 (C,DD)	2.7E+7
n-Butyl acetate	123864	NA	11,000	32,000	NA	1.1E+6 (C)	1.1E+6 (C)	1.4E+8	3.1E+8	3.5E+8	2.1E+11	1.1E+6 (C)	1.1E+6 (C)	1.1E+6 (C)	1.1E+6
t-Butyl alcohol	75650	NA	78,000	2.2E+5	NA	1.1E+8 (C)	1.1E+8 (C)	1.2E+8	2.4E+8	2.4E+8	5.6E+10	1.1E+8 (C)	1.1E+8 (C)	1.1E+8 (C)	1.1E+8
Butyl benzyl phthalate	85687	NA	3.1E+5 (C)	3.1E+5 (C)	26,000 (X)	3.1E+5 (C)	NLV	NLV	NLV	NLV	2.1E+10	3.1E+5 (C)	3.1E+5 (C)	3.1E+5 (C)	3.1E+5
n-Butylbenzene	104518	NA	1,600	4,600	ID	1.2E+5	ID	ID	ID	ID	ID	8.0E+6	1.0E+7 (C)	9.4E+6	1.0E+7
sec-Butylbenzene	135988	NA	1,600	4,600	ID	88,000	ID	ID	ID	ID	ID	8.0E+6	1.0E+7 (C)	9.4E+6	1.0E+7
t-Butylbenzene (I)	98066	NA	1,600	4,600	NA	1.8E+5	ID	ID	ID	ID	ID	8.0E+6	1.0E+7 (C)	9.4E+6	1.0E+7
Cadmium (B)	7440439	1,200	6,000	6,000	(G,X)	2.3E+8	NLV	NLV	NLV	NLV	2.2E+6	2.1E+6	2.1E+6	2.1E+6	NA
Camphene (I)	79925	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	NA
Caprolactam	105602	NA	1.2E+5	3.4E+5	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	2.9E+8	3.1E+8 (DD)	4.8E+8 (DD)	3.8E+8 (DD)	NA
Carbaryl	63252	NA	14,000	40,000	NA	2.6E+6	ID	ID	ID	ID	ID	7.0E+7	9.8E+7	8.2E+7	NA
Carbazole	86748	NA	9,400	39,000	1,100	8.2E+5	NLV	NLV	NLV	NLV	ID	2.4E+6	3.4E+6	2.9E+6	NA
Carbofuran	1563662	NA	800	800	NA	6.8E+6	NLV	NLV	NLV	NLV	ID	3.6E+6	5.1E+6	4.3E+6	NA
Carbon disulfide (I,R)	75150	NA	16,000	46,000	ID	2.8E+5 (C)	1.4E+5	1.6E+6	8.0E+6	1.9E+7	2.1E+10	2.8E+5 (C,DD)	2.8E+5 (C,DD)	2.8E+5 (C,DD)	2.8E+5
Carbon tetrachloride	56235	NA	100	100	900 (X)	92,000	990	12,000	34,000	79,000	1.7E+8	3.9E+5 (C)	3.9E+5 (C)	3.9E+5 (C)	3.9E+5
Chlordane (J)	57749	NA	NLL	NLL	NLL	NLL	5.9E+7	4.2E+6	4.2E+6	4.2E+6	2.1E+7	1.5E+5	2.0E+5	1.7E+5	NA
Chloride	16887006	NA	5.0E+6	5.0E+6	2.5E+6 (X)	ID	NLV	NLV	NLV	NLV	ID	5.0E+5 (F)	5.0E+5 (F)	5.0E+5 (F)	NA
Chlorobenzene (I)	108907	NA	2,000	2,000	940	2.6E+5 (C)	2.2E+5	9.2E+5	1.1E+6	2.1E+6	2.1E+9	2.6E+5 (C)	2.6E+5 (C)	2.6E+5 (C)	2.6E+5



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
Guidesheet Number →		#10	#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
para-Chlorobenzenesulfonic acid	98668	NA	1.5E+05	4.2E+05	NA	NA	ID	ID	ID	ID	ID	7.3E+08	1.0E+09	8.6E+08	ID
1-Chloro-1,1-difluoroethane	75683	NA	3.0E+5	8.8E+05	NA	9.6E+5 (C)	9.6E+5 (C)	9.4E+7	5.7E+8	1.4E+9	1.5E+12	9.6E+5 (C)	9.6E+5 (C)	9.6E+5 (C)	9.6E+5
Chloroethane	75003	NA	8,600	34,000	ID	9.5E+5 (C)	9.5E+5 (C)	3.6E+7	1.2E+8	2.8E+8	2.9E+11	9.5E+5 (C)	9.5E+5 (C)	9.5E+5 (C)	9.5E+5
2-Chloroethyl vinyl ether	110758	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	1.9E+6
Chloroform	67663	NA	1,600 (W)	1,600 (W)	3,400 (X)	1.5E+6 (C)	38,000	1.5E+5	3.4E+5	7.9E+5	1.6E+9	1.5E+6 (C)	1.5E+6 (C)	1.5E+6 (C)	1.5E+6
Chloromethane (I)	74873	NA	5,200	22,000	ID	1.1E+6 (C)	10,000	1.2E+5	1.0E+6	2.5E+6	2.6E+9	1.1E+6 (C)	1.1E+6 (C)	1.1E+6 (C)	1.1E+6
4-Chloro-3-methylphenol	59507	NA	5,800	16,000	280	3.0E+6	NLV	NLV	NLV	NLV	ID	1.5E+7	2.0E+7	1.7E+7	NA
beta-Chloronaphthalene	91587	NA	6.2E+5	1.8E+6	NA	2.3E+6	ID	ID	ID	ID	ID	1.8E+8	2.6E+8	2.1E+8	NA
2-Chlorophenol	95578	NA	900	2,600	440	1.9E+6	ID	ID	ID	ID	ID	4.5E+6	6.3E+6	5.3E+6	1.9E+7
o-Chlorotoluene (I)	95498	NA	3,300	9,300	NA	5.0E+5 (C)	5.0E+5 (C)	1.5E+6	3.1E+6	6.4E+6	2.1E+9	5.0E+5 (C)	5.0E+5 (C)	5.0E+5 (C)	5.0E+5
Chlorpyrifos	2921882	NA	17,000	48,000	1,500	8.4E+5	240	5,500	23,000	56,000	5.9E+7	3.4E+7	6.0E+7	4.4E+7	NA
Chromium (III) (B,H)	16065831	18,000 (total)	1.0E+9 (D)	1.0E+9 (D)	(G,X)	1.0E+9 (D)	NLV	NLV	NLV	NLV	1.5E+8	1.0E+9 (D)	1.0E+9 (D)	1.0E+9 (D)	NA
Chromium (VI)	18540299	NA	30,000	30,000	3,300	1.4E+8	NLV	NLV	NLV	NLV	2.4E+5	9.2E+6	1.0E+7	9.6E+6	NA
Chrysene (Q)	218019	NA	NLL	NLL	NLL	NLL	ID	ID	ID	ID	ID	8.0E+6	1.6E+7	1.1E+7	NA
Cobalt	7440484	6,800	800	2,000	2,000	4.8E+7	NLV	NLV	NLV	NLV	5.9E+6	9.0E+6	1.0E+7	1.0E+7	NA
Copper (B)	7440508	32,000	5.8E+6	5.8E+6	(G)	1.0E+9 (D)	NLV	NLV	NLV	NLV	5.9E+7	7.3E+7	7.9E+7	7.6E+7	NA
Cyanazine	21725462	NA	200	200	1,100 (X)	56,000	NLV	NLV	NLV	NLV	ID	66,000	92,000	77,000	NA
Cyanide (P,R)	57125	390 (total)	4,000	4,000	100	2.5E+5	NLV	NLV	NLV	NLV	2.5E+5	2.5E+5	2.5E+5	2.5E+5	NA
Cyclohexanone	108941	NA	5.2E+6	1.5E+7	NA	2.2E+8 (C)	32,000	1.3E+6	1.1E+7	2.7E+7	2.9E+10	2.2E+8 (C)	2.2E+8 (C)	2.2E+8 (C)	2.2E+8
Dacthal	1861321	NA	50,000	1.4E+5	NA	3.4E+5	NLV	NLV	NLV	NLV	ID	7.3E+6	1.0E+7	8.6E+6	NA
Dalapon	75990	NA	4,000	4,000	NA	5.9E+7 (C)	NLV	NLV	NLV	NLV	ID	5.9E+7 (C)	5.9E+7 (C)	5.9E+7 (C)	5.9E+7
4-4'-DDD	72548	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	5.6E+7	4.0E+5	7.1E+5	5.2E+5	NA
4-4'-DDE	72559	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	4.0E+7	1.9E+5	3.3E+5	2.4E+5	NA
4-4'-DDT	50293	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	4.0E+7	2.8E+5	3.4E+5	3.1E+5	NA



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
Guidesheet Number →		#10	#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Decabromodiphenyl ether	1163195	NA	1.4E+5	1.4E+5	NA	1.4E+5	1.0E+9 (D)	1.0E+8	1.0E+8	1.0E+8	1.0E+9	1.1E+7	2.0E+7	1.5E+7	NA
Di-n-butyl phthalate	84742	NA	7.6E+5 (C)	7.6E+5 (C)	11,000	7.6E+5 (C)	NLV	NLV	NLV	NLV	1.5E+9	7.6E+5 (C)	7.6E+5 (C)	7.6E+5 (C)	7.6E+5
Di(2-ethylhexyl) adipate	103231	NA	9.6E+5 (C)	9.6E+5 (C)	NA	9.6E+5 (C)	NLV	NLV	NLV	NLV	1.2E+10	9.6E+5 (C,DD)	9.6E+5 (C,DD)	9.6E+5 (C,DD)	9.6E+5
Di-n-octyl phthalate	117840	NA	1.0E+8	1.4E+8 (C)	ID	1.4E+8 (C)	NLV	NLV	NLV	NLV	ID	2.0E+7	3.6E+7	2.6E+7	1.4E+8
Diacetone alcohol (I)	123422	NA	ID	ID	NA	ID	NLV	NLV	NLV	NLV	7.1E+10	ID	ID	ID	1.1E+8
Diazinon	333415	NA	95	280	NA	95,000	NLV	NLV	NLV	NLV	ID	70,000 (DD)	1.1E+5 (DD)	86,000 (DD)	3.1E+5
Dibenzo(a,h)anthracene (Q)	53703	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	8,000	16,000	11,000	NA
Dibenzofuran	132649	NA	ID	ID	1,700	ID	ID	ID	ID	ID	ID	ID	ID	ID	NA
Dibromochloromethane	124481	NA	1,600 (W)	1,600 (W)	ID	3.6E+5	21,000	80,000	80,000	98,000	1.6E+8	5.0E+5	6.1E+5 (C)	5.8E+5	6.1E+5
Dibromochloropropane	98128	NA	10 (M); 4.0	10 (M); 4.0	NA	1,200 (C)	1,200 (C)	15,000	15,000	15,000	5.9E+6	1,200 (C)	1,200 (C)	1,200 (C)	1,200
Dibromomethane	74953	NA	1,600	4,600	NA	2.0E+6 (C)	ID	ID	ID	ID	ID	2.0E+6 (C)	2.0E+6 (C)	2.0E+6 (C)	2.0E+6
Dicamba	1918009	NA	4,400	13,000	NA	1.2E+7	NLV	NLV	NLV	NLV	ID	1.7E+7	3.5E+7	2.3E+7	NA
1,2-Dichlorobenzene	95501	NA	14,000	14,000	360	2.1E+5 (C)	2.1E+5 (C)	4.6E+7	4.6E+7	5.5E+7	4.4E+10	2.1E+5 (C)	2.1E+5 (C)	2.1E+5 (C)	2.1E+5
1,3-Dichlorobenzene	541731	NA	170	480	1,100	51,000	ID	ID	ID	ID	ID	1.7E+5 (C)	1.7E+5 (C)	1.7E+5 (C)	1.7E+5
1,4-Dichlorobenzene	106467	NA	1,700	1,700	290	1.4E+5	1.0E+5	2.6E+5	2.6E+5	3.4E+5	5.7E+8	1.9E+6	2.6E+6	2.2E+6	NA
3,3'-Dichlorobenzidine	91941	NA	2,000 (M); 28	2,000 (M); 110	2,000 (M,X); 510	4,600	NLV	NLV	NLV	NLV	8.2E+6	30,000	43,000	36,000	NA
Dichlorodifluoromethane	75718	NA	95,000	2.7E+5	ID	1.0E+6 (C)	1.7E+6	6.3E+7	5.5E+8	1.4E+9	1.5E+12	1.0E+6 (C)	1.0E+6 (C)	1.0E+6 (C)	1.0E+6
1,1-Dichloroethane	75343	NA	18,000	50,000	15,000	8.9E+5 (C)	4.3E+5	2.5E+6	6.0E+6	1.4E+7	1.5E+10	8.9E+5 (C)	8.9E+5 (C)	8.9E+5 (C)	8.9E+5
1,2-Dichloroethane (I)	107062	NA	100	100	7,200 (X)	3.8E+5	11,000	21,000	33,000	74,000	1.5E+8	4.2E+5	5.9E+5	4.9E+5	1.2E+6
1,1-Dichloroethylene (I)	75354	NA	140	140	1,300 (X)	2.2E+5	330	3,700	15,000	37,000	7.8E+7	5.7E+5 (C)	5.7E+5 (C)	5.7E+5 (C)	5.7E+5
cis-1,2-Dichloroethylene	156592	NA	1,400	1,400	12,000	6.4E+5 (C)	41,000	2.1E+5	4.3E+5	1.0E+6	1.0E+9	6.4E+5 (C)	6.4E+5 (C)	6.4E+5 (C)	6.4E+5
trans-1,2-Dichloroethylene	156605	NA	2,000	2,000	30,000	1.4E+6 (C)	43,000	3.3E+5	8.4E+5	2.0E+6	2.1E+9	1.4E+6 (C)	1.4E+6 (C)	1.4E+6 (C)	1.4E+6
2,6-Dichloro-4-nitroaniline	99309	NA	44,000	1.3E+5	NA	1.4E+5	NLV	NLV	NLV	NLV	ID	2.2E+8	3.1E+8	2.6E+8	NA
2,4-Dichlorophenol	120832	NA	1,500	4,200	380	9.6E+5	NLV	NLV	NLV	NLV	2.3E+9	1.8E+6 (C,DD)	1.8E+6 (C,DD)	1.8E+6 (C,DD)	1.8E+6



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
			#10	#21	#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
2,4-Dichlorophenoxyacetic acid	94757	NA	1,400	1,400	4,400	2.4E+6	NLV	NLV	NLV	NLV	2.9E+9	8.6E+6	1.0E+7	9.4E+6	NA
1,2-Dichloropropane (I)	78875	NA	100	100	5,800 (X)	3.2E+5	7,400	30,000	51,000	1.2E+5	1.2E+8	5.5E+5 (C)	5.5E+5 (C)	5.5E+5 (C)	5.5E+5
1,3-Dichloropropene	542756	NA	170	700	NA	1.1E+5	5,400	60,000	2.0E+5	4.7E+5	5.9E+8	2.4E+5	3.4E+5	2.9E+5	6.2E+5
Dichlorovos	62737	NA	50 (M); 32	130	NA	1.2E+5	NLV	NLV	NLV	NLV	1.5E+7	47,000	65,000	55,000	2.2E+6
Dicyclohexyl phthalate	84617	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	NA
Dieldrin	60571	NA	NLL	NLL	NLL	NLL	7.2E+5	64,000	64,000	64,000	8.5E+5	4,700	8,300	6,100	NA
Diethyl ether	60297	NA	200	200	ID	7.4E+6 (C)	7.4E+6 (C)	1.0E+8	1.6E+8	3.5E+8	3.5E+11	7.4E+6 (C)	7.4E+6 (C)	7.4E+6 (C)	7.4E+6
Diethyl phthalate	84662	NA	1.1E+5	3.2E+5	2,200	7.4E+5 (C)	NLV	NLV	NLV	NLV	1.5E+9	7.4E+5 (C)	7.4E+5 (C)	7.4E+5 (C)	7.4E+5
Diethylene glycol monobutyl ether	112345	NA	1,800	5,000	NA	8.0E+7	NLV	NLV	NLV	NLV	5.9E+8	8.7E+6	1.2E+7	1.0E+7	1.1E+8
Diisopropyl ether	108203	NA	600	1,300 (C)	ID	1,300 (C)	1,300 (C)	3.2E+6	4.8E+6	1.0E+7	1.1E+10	1,300 (C)	1,300 (C)	1,300 (C)	1,300
Diisopropylamine (I)	108189	NA	110	320	NA	4.2E+5	ID	ID	ID	ID	ID	5.6E+5	7.9E+5	6.6E+5	6.7E+6
Dimethyl phthalate	131113	NA	7.9E+5 (C)	7.9E+5 (C)	NA	7.9E+5 (C)	NLV	NLV	NLV	NLV	1.5E+9	7.9E+5 (C)	7.9E+5 (C)	7.9E+5 (C)	7.9E+5
N,N-Dimethylacetamide	127195	NA	3,600	10,000	82,000 (X)	1.1E+8 (C)	NLV	NLV	NLV	NLV	ID	1.8E+7	2.6E+7	2.1E+7	1.1E+8
N,N-Dimethylaniline	121697	NA	320	920	NA	4.0E+5	8.0E+5 (C)	5.2E+5	5.2E+5	5.2E+5	3.3E+8	8.0E+5 (C)	8.0E+5 (C)	8.0E+5 (C)	8.0E+5
Dimethylformamide (I)	68122	NA	14,000	40,000	NA	1.1E+8 (C)	NLV	NLV	NLV	NLV	8.8E+8	7.0E+7	9.8E+7	8.2E+7	1.1E+8
2,4-Dimethylphenol	105679	NA	7,400	20,000	7,600	1.0E+7	NLV	NLV	NLV	NLV	2.1E+9	3.6E+7	5.1E+7	4.3E+7	NA
2,6-Dimethylphenol	576261	NA	330 (M); 88	330 (M); 260	NA	1.3E+5	NLV	NLV	NLV	NLV	ID	4.4E+5	6.1E+5	5.1E+5	NA
3,4-Dimethylphenol	95658	NA	330 (M); 200	580	NA	3.6E+5	NLV	NLV	NLV	NLV	ID	1.0E+6	1.4E+6	1.2E+6	NA
Dimethylsulfoxide	67685	NA	4.4E+6	1.3E+7	3.8E+6	1.8E+7 (C)	NLV	NLV	NLV	NLV	ID	1.8E+7 (C)	1.8E+7 (C)	1.8E+7 (C)	1.8E+7
2,4-Dinitrotoluene	121142	NA	430	640	NA	1.7E+5	NLV	NLV	NLV	NLV	2.0E+7	2.2E+5	3.1E+5	2.6E+5	NA
Dinoseb	88857	NA	300	300	200 (M); 43	1.4E+5 (C)	NLV	NLV	NLV	NLV	ID	1.4E+5 (C,DD)	1.4E+5 (C,DD)	1.4E+5 (C,DD)	1.4E+5
1,4-Dioxane (I)	123911	NA	1,700	7,000	56,000	3.4E+7	NLV	NLV	NLV	NLV	7.1E+8	2.4E+6	3.4E+6	2.9E+6	9.7E+7
Diquat	85007	NA	400	400	NA	1.4E+7	NLV	NLV	NLV	NLV	ID	1.6E+6	2.2E+6	1.9E+6	NA
Diuron	330541	NA	620	1,800	NA	7.4E+5	NLV	NLV	NLV	NLV	2.1E+8	3.1E+6	4.4E+6	3.7E+6	NA



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
#10			#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Endosulfan (J)	115297	NA	NLL	NLL	NLL	NLL	ID	ID	ID	ID	ID	4.4E+6	6.1E+6	5.1E+6	NA
Endothall	145733	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	1.0E+9	1.2E+7	1.7E+7	1.5E+7	NA
Endrin	72208	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	1.9E+5	3.4E+5	2.5E+5	NA
Epichlorohydrin (I)	106898	NA	100	100	NA	2.2E+5	1.2E+5	37,000	37,000	37,000	2.9E+7	41,000	58,000	48,000	7.3E+6
Ethanol (I)	64175	NA	3.8E+7	7.6E+7	NA	1.1E+8 (C)	NLV	NLV	NLV	NLV	5.6E+11	1.1E+8 (C,DD)	1.1E+8 (C,DD)	1.1E+8 (C,DD)	1.1E+8
Ethyl acetate (I)	141786	NA	1.3E+5	3.8E+5	NA	7.5E+6 (C)	7.5E+6 (C)	5.9E+7	5.9E+7	1.0E+8	9.4E+10	7.5E+6 (C)	7.5E+6 (C)	7.5E+6 (C)	7.5E+6
Ethyl-tert-butyl ether (ETBE)	637923	NA	980	980	ID	ID	6.5E+5 (C)	2.3E+6	4.6E+6	1.1E+7	1.1E+10	ID	ID	ID	6.5E+5
Ethylbenzene (I)	100414	NA	1,500	1,500	360	1.4E+5 (C)	1.4E+5 (C)	2.4E+6	3.1E+6	6.5E+6	1.3E+10	1.4E+5 (C)	1.4E+5 (C)	1.4E+5 (C)	1.4E+5
Ethylene dibromide	106934	NA	20 (M); 1.0	20 (M); 1.0	20 (M); 4.0	500	3,600	5,800	5,800	9,800	1.8E+7	430	600	500	8.9E+5
Ethylene glycol	107211	NA	3.0E+5	8.4E+5	NA	1.1E+8 (C)	NLV	NLV	NLV	NLV	2.9E+10	1.1E+8 (C)	1.1E+8 (C)	1.1E+8 (C)	1.1E+8
Ethylene glycol monobutyl ether	111762	NA	74,000	2.0E+5	NA	4.1E+7 (C)	1.4E+6	2.1E+7	1.5E+8	3.6E+8	3.8E+11	4.1E+7 (C)	4.1E+7 (C)	4.1E+7 (C)	4.1E+7
Fluoranthene	206440	NA	7.3E+5	7.3E+5	5,500	7.3E+5	1.0E+9 (D)	8.9E+8	8.8E+8	8.8E+8	4.1E+9	1.3E+8	2.4E+8	1.7E+8	NA
Fluorene	86737	NA	3.9E+5	8.9E+5	5,300	8.9E+5	1.0E+9 (D)	1.5E+8	1.5E+8	1.5E+8	4.1E+9	8.7E+7	1.2E+8	1.0E+8	NA
Fluorine (soluble fluoride) (B)	7782414	NA	40,000	40,000	NA	2.4E+8	NLV	NLV	NLV	NLV	ID	6.7E+7 (DD)	7.4E+7 (DD)	7.0E+7 (DD)	NA
Formaldehyde	50000	NA	28,000	76,000	2,400	6.0E+7 (C)	65,000	43,000	69,000	1.5E+5	3.0E+8	6.0E+7 (C)	6.0E+7 (C)	6.0E+7 (C)	6.0E+7
Formic acid (I,U)	64186	NA	2.0E+5	5.8E+5	ID	1.1E+8 (C)	2.8E+6	2.6E+5	1.6E+5	1.6E+5	5.9E+7	1.1E+8 (C)	1.1E+8 (C)	1.1E+8 (C)	1.1E+8
1-Formylpiperidine	2591868	NA	1,600	4,800	NA	ID	ID	ID	ID	ID	ID	8.0E+6	1.0E+7 (C)	9.4E+6	1.0E+7
Gentian violet	548629	NA	300	1,300	NA	2.0E+7	NLV	NLV	NLV	NLV	ID	4.4E+5	6.2E+5	5.2E+5	NA
Glyphosate	1071836	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	5.7E+7 (DD)	1.2E+8 (DD)	7.8E+7 (DD)	NA
Heptachlor	76448	NA	NLL	NLL	NLL	NLL	1.9E+6	2.1E+5	2.1E+5	2.1E+5	3.0E+6	23,000	42,000	30,000	NA
Heptachlor epoxide	1024573	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	1.5E+6	9,500	17,000	12,000	NA
n-Heptane	142825	NA	2.4E+5 (C)	2.4E+5 (C)	NA	2.4E+5 (C)	2.4E+5 (C)	2.5E+7	4.5E+7	1.0E+8	1.0E+11	2.4E+5 (C)	2.4E+5 (C)	2.4E+5 (C)	2.4E+5
Hexabromobenzene	87821	NA	5,400	5,400	ID	5,400	ID	ID	ID	ID	ID	3.1E+6	5.6E+6	4.1E+6	NA
Hexachlorobenzene (C-66)	118741	NA	1,800	1,800	350	8,200	2.2E+5	56,000	56,000	56,000	8.5E+6	37,000	67,000	49,000	NA



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PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
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Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Hexachlorobutadiene (C-46)	87683	NA	28,000	72,000	91	3.5E+5 (C)	3.5E+5 (C)	4.6E+5	4.6E+5	4.6E+5	1.8E+8	3.5E+5 (C)	3.5E+5 (C)	3.5E+5 (C)	3.5E+5
alpha-Hexachlorocyclohexane	319846	NA	18	71	NA	2,500	1.6E+5	41,000	86,000	86,000	2.1E+6	12,000	17,000	14,000	NA
beta-Hexachlorocyclohexane	319857	NA	37	150	NA	5,100	NLV	NLV	NLV	NLV	7.4E+6	25,000	35,000	29,000	NA
Hexachlorocyclopentadiene (C-56)	77474	NA	3.2E+5	3.2E+5	ID	7.2E+5 (C)	56,000	60,000	60,000	60,000	5.9E+6	7.2E+5 (C)	7.2E+5 (C)	7.2E+5 (C)	7.2E+5
Hexachloroethane	67721	NA	430	1,200	1,800 (X)	1.1E+5	79,000	6.6E+5	1.4E+6	1.4E+6	1.0E+8	7.3E+5	1.0E+6	8.6E+5	NA
n-Hexane	110543	NA	44,000 (C)	44,000 (C)	NA	44,000 (C)	44,000 (C)	3.5E+6	3.5E+6	6.4E+6	5.9E+9	44,000 (C)	44,000 (C)	44,000 (C)	44,000
2-Hexanone	591786	NA	20,000	58,000	NA	2.5E+6 (C)	1.8E+6	1.3E+6	1.3E+6	1.5E+6	1.2E+9	2.5E+6 (C)	2.5E+6 (C)	2.5E+6 (C)	2.5E+6
Indeno(1,2,3-cd)pyrene (Q)	193395	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	80,000	1.6E+5	1.1E+5	NA
Iron (B)	7439896	1.2E+7	6,000	6,000	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	5.8E+8	6.2E+8	6.0E+8	NA
Isobutyl alcohol (I)	78831	NA	46,000	1.3E+5	NA	8.9E+6 (C)	8.9E+6 (C)	9.5E+7	9.5E+7	9.5E+7	4.4E+10	8.9E+6 (C)	8.9E+6 (C)	8.9E+6 (C)	8.9E+6
Isophorone	78591	NA	15,000	62,000	11,000 (X)	2.4E+6 (C)	NLV	NLV	NLV	NLV	8.2E+9	2.4E+6 (C)	2.4E+6 (C)	2.4E+6 (C)	2.4E+6
Isopropyl alcohol (I)	67630	NA	9,400	26,000	1.1E+6 (X)	1.1E+8 (C)	NLV	NLV	NLV	NLV	6.5E+9	4.7E+7	6.5E+7	5.5E+7	1.1E+8
Isopropyl benzene	98828	NA	91,000	2.6E+5	ID	3.9E+5 (C)	3.9E+5 (C)	2.0E+6	2.0E+6	3.0E+6	2.6E+9	3.9E+5 (C)	3.9E+5 (C)	3.9E+5 (C)	3.9E+5
Lead (B)	7439921	21,000	7.0E+5	7.0E+5	(G,X)	ID	NLV	NLV	NLV	NLV	4.4E+7	9.0E+5 (DD)	4.0E+5	4.0E+5	NA
Lindane	58899	NA	20 (M); 7.0	20 (M); 7.0	20 (M); 0.99	7,100	ID	ID	ID	ID	ID	42,000	49,000	45,000	NA
Lithium (B)	7439932	9,800	3,400	7,000	1,900	1.1E+8	NLV	NLV	NLV	NLV	ID	3.1E+7 (DD)	3.5E+7 (DD)	3.3E+7 (DD)	NA
Magnesium (B)	7439954	NA	8.0E+6	2.2E+7	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	2.9E+9	1.0E+9 (D)	1.0E+9 (D)	1.0E+9 (D)	NA
Manganese (B)	7439965	4.4E+5	1,000	1,000	(G,X)	1.8E+8	NLV	NLV	NLV	NLV	1.5E+6	9.0E+7	9.8E+7	9.4E+7	NA
Mercury (Total) (B,Z)	Varies	130	1,700	1,700	50 (M); 1.2	47,000	89,000	62,000	62,000	62,000	8.8E+6	5.8E+5	6.2E+5	6.0E+5	NA
Methane	74828	NA	ID	ID	NA	ID	8.4E+6 ug/m3 (GG)	ID	ID	ID	ID	ID	ID	ID	ID
Methanol	67561	NA	74,000	2.0E+5	9,600	3.1E+6 (C)	3.1E+6 (C)	3.7E+7	4.6E+7	9.7E+7	9.6E+10	3.1E+6 (C)	3.1E+6 (C)	3.1E+6 (C)	3.1E+6
Methoxychlor	72435	NA	16,000	16,000	NA	16,000	ID	ID	ID	ID	ID	5.6E+6	1.0E+7	7.3E+6	NA
2-Methoxyethanol (I)	109864	NA	150	420	NA	1.7E+7	NLV	NLV	NLV	NLV	5.9E+8	7.3E+5	1.0E+6	8.6E+5	1.1E+6
2-Methyl-4-chlorophenoxyacetic acid	94746	NA	390	1,100	NA	4.9E+5	NLV	NLV	NLV	NLV	ID	7.3E+5	1.0E+6	8.6E+5	NA



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
#10			#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
2-Methyl-4,6-dinitrophenol	534521	NA	830 (M); 400	830 (M); 400	NA	1.9E+5	NLV	NLV	NLV	NLV	ID	2.6E+5	3.6E+5	3.0E+5	NA
N-Methyl-morpholine (I)	109024	NA	400	1,100	NA	3.0E+7	NLV	NLV	NLV	NLV	ID	2.0E+6	2.8E+6	2.3E+6	1.1E+8
Methyl parathion	298000	NA	46	130	NA	76,000	NLV	NLV	NLV	NLV	ID	1.8E+5	2.6E+5	2.1E+5	NA
4-Methyl-2-pentanone (MIBK) (I)	108101	NA	36,000	1.0E+5	ID	2.7E+6 (C)	2.7E+6 (C)	5.3E+7	5.3E+7	7.0E+7	6.0E+10	2.7E+6 (C)	2.7E+6 (C)	2.7E+6 (C)	2.7E+6
Methyl-tert-butyl ether (MTBE)	1634044	NA	800	800	15,000 (X)	5.9E+6 (C)	5.9E+6 (C)	3.0E+7	4.1E+7	8.9E+7	8.8E+10	5.9E+6 (C)	5.9E+6 (C)	5.9E+6 (C)	5.9E+6
Methylcyclopentane (I)	96377	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	3.5E+5
4,4'-Methylene-bis-2-chloroaniline (MBOCA)	101144	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	1.1E+8	32,000	44,000	37,000	NA
Methylene chloride	75092	NA	100	100	19,000 (X)	2.3E+6 (C)	2.4E+5	7.0E+5	1.7E+6	4.0E+6	8.3E+9	2.3E+6 (C)	2.3E+6 (C)	2.3E+6 (C)	2.3E+6
2-Methylnaphthalene	91576	NA	57,000	1.7E+5	ID	5.5E+6	ID	ID	ID	ID	ID	2.6E+7	3.7E+7	3.1E+7	NA
Methylphenols (J)	1319773	NA	7,400	20,000	1,400	1.6E+7	NLV	NLV	NLV	NLV	2.9E+9	3.6E+7	5.1E+7	4.3E+7	NA
Metolachlor	51218452	NA	4,800	20,000	NA	4.4E+5 (C)	NLV	NLV	NLV	NLV	ID	4.4E+5 (C,DD)	4.4E+5 (C,DD)	4.4E+5 (C,DD)	4.4E+5
Metribuzin	21087649	NA	3,600	10,000	NA	2.40E+07	ID	ID	ID	ID	ID	2.8E+7	5.0E+7	3.6E+7	NA
Mirex	2385855	NA	NLL	NLL	NLL	NLL	ID	ID	ID	ID	ID	40,000	72,000	52,000	NA
Molybdenum (B)	7439987	NA	1,500	4,200	16,000 (X)	1.9E+7	NLV	NLV	NLV	NLV	ID	9.6E+6	1.0E+7	1.0E+7	NA
Naphthalene	91203	NA	35,000	1.0E+5	870	2.1E+6	4.7E+5	3.5E+5	3.5E+5	3.5E+5	8.8E+7	5.2E+7	7.2E+7	6.1E+7	NA
Nickel (B)	7440020	20,000	1.0E+5	1.0E+5	(G)	1.0E+9 (D)	NLV	NLV	NLV	NLV	1.6E+7	1.5E+8	1.6E+8	1.5E+8	NA
Nitrate (B,N)	14797558	NA	2.0E+5 (N)	2.0E+5 (N)	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	ID	ID	ID	NA
Nitrite (B,N)	14797650	NA	20,000 (N)	20,000 (N)	NA	3.8E+8	NLV	NLV	NLV	NLV	ID	ID	ID	ID	NA
Nitrobenzene (I)	98953	NA	330 (M); 68	330 (M); 190	3,600 (X)	2.2E+5	1.7E+5	64,000	64,000	64,000	2.1E+7	3.4E+5	4.7E+5	3.9E+5	4.9E+5
2-Nitrophenol	88755	NA	400	1,200	ID	1.6E+6	NLV	NLV	NLV	NLV	ID	2.0E+6	2.9E+6	2.4E+6	NA
n-Nitroso-di-n-propylamine	621647	NA	330 (M); 100	330 (M); 100	NA	7,200	NLV	NLV	NLV	NLV	2.0E+6	5,400	7,600	6,400	1.5E+6
N-Nitrosodiphenylamine	86306	NA	5,400	22,000	NA	7.0E+5	NLV	NLV	NLV	NLV	ID	7.8E+6	1.1E+7	9.2E+6	NA
Oxamyl	23135220	NA	4,000	4,000	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	2.8E+7	3.9E+7	3.3E+7	NA
Oxo-hexyl acetate	88230357	NA	1,500	4,200	NA	ID	ID	ID	ID	ID	2.4E+9	7.3E+6	1.0E+7	8.6E+6	1.0E+7



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
#10			#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Pendimethalin	40487421	NA	1.1E+6	1.1E+6	NA	1.1E+6	NLV	NLV	NLV	NLV	ID	1.3E+8	2.4E+8	1.7E+8	NA
Pentachlorobenzene	608935	NA	29,000	81,000	9,500	1.9E+5 (C)	ID	ID	ID	ID	ID	1.9E+5 (C)	1.9E+5 (C)	1.9E+5 (C)	1.9E+5
Pentachloronitrobenzene	82688	NA	37,000	37,000	NA	37,000	2.2E+5	2.8E+5	2.8E+5	2.8E+5	1.5E+8	5.5E+6	7.7E+6	6.4E+6	NA
Pentachlorophenol	87865	NA	22	22	(G,X)	4,300	NLV	NLV	NLV	NLV	1.3E+8	3.2E+5	9.2E+5	4.9E+5	NA
Pentane	109660	NA	ID	ID	NA	ID	1.8E+5	4.4E+7	3.4E+8	6.0E+08	5.3E+11	ID	ID	ID	2.4E+5
2-Pentene (I)	109682	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	2.2E+5
Phenanthrene	85018	NA	56,000	1.6E+5	5,300	1.1E+6	5.1E+6	1.9E+5	1.9E+5	1.9E+5	2.9E+6	5.2E+6	7.2E+6	6.1E+6	NA
Phenol	108952	NA	88,000	2.6E+5	4,200	1.2E+7 (C)	NLV	NLV	NLV	NLV	1.8E+10	1.2E+7 (C,DD)	1.2E+7 (C,DD)	1.2E+7 (C,DD)	1.2E+7
Phosphorus (Total)	7723140	NA	1.3E+6	4.8E+6	(EE)	ID	NLV	NLV	NLV	NLV	ID	1.0E+9 (D)	1.0E+9 (D)	1.0E+9 (D)	NA
Phthalic acid	88993	NA	2.8E+5	8.0E+5	NA	1.7E+6 (C)	NLV	NLV	NLV	NLV	ID	1.7E+6 (C)	1.7E+6 (C)	1.7E+6 (C)	1.7E+6
Phthalic anhydride	85449	NA	3.0E+5	8.8E+5	NA	1.1E+6 (C)	NLV	NLV	NLV	NLV	ID	1.1E+6 (C)	1.1E+6 (C)	1.1E+6 (C)	1.1E+6
Picloram	1918021	NA	10,000	10,000	920	8.6E+6	NLV	NLV	NLV	NLV	ID	5.1E+7	7.1E+7	6.0E+7	NA
Piperidine	110894	NA	64	180	NA	6.8E+5	NLV	NLV	NLV	NLV	4.1E+9	3.2E+5	4.5E+5	3.8E+5	1.2E+8
Polybrominated biphenyls (J)	67774327	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	ID	4,800	8,600	6,300	NA
Polychlorinated biphenyls (PCBs) (J,T)	1336363	NA	NLL	NLL	NLL	NLL	1.6E+7	8.1E+5	2.8E+7	2.8E+7	6.5E+8	(T)	(T)	(T)	NA
Prometon	1610180	NA	4,900	14,000	NA	5.5E+6	NLV	NLV	NLV	NLV	ID	1.6E+7	2.2E+7	1.9E+7	NA
Propachlor	1918167	NA	1,900	5,400	NA	8.8E+6	NLV	NLV	NLV	NLV	ID	9.5E+6	1.3E+7	1.1E+7	NA
Propazine	139402	NA	4,000	11,000	NA	1.7E+5	NLV	NLV	NLV	NLV	ID	2.0E+7	2.8E+7	2.3E+7	NA
Propionic acid	79094	NA	2.4E+5	7.0E+5	NA	1.1E+8 (C)	NLV	NLV	NLV	NLV	8.8E+9	1.1E+8 (C)	1.1E+8 (C)	1.1E+8 (C)	1.1E+8
Propyl alcohol (I)	71238	NA	28,000	80,000	NA	1.1E+8 (C)	NLV	NLV	NLV	NLV	2.1E+10	7.4E+7 (DD)	1.1E+8 (DD)	9.1E+7 (DD)	1.1E+8
n-Propylbenzene (I)	103651	NA	1,600	4,600	NA	3.0E+5	ID	ID	ID	ID	5.9E+8	8.0E+6	1.0E+7 (C)	9.4E+6	1.0E+7
Propylene glycol	57556	NA	3.0E+6	8.4E+6	5.8E+6	1.1E+8 (C)	NLV	NLV	NLV	NLV	1.8E+11	1.1E+8 (C)	1.1E+8 (C)	1.1E+8 (C)	1.1E+8
Pyrene	129000	NA	4.8E+5	4.8E+5	ID	4.8E+5	1.0E+9 (D)	7.8E+8	7.8E+8	7.8E+8	2.9E+9	8.4E+7	1.5E+8	1.1E+8	NA
Pyridine (I)	110861	NA	400	420	NA	37,000 (C)	2,000	9,800	40,000	97,000	1.0E+8	37,000 (C)	37,000 (C)	37,000 (C)	37,000



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
Guidesheet Number →		#10	#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Selenium (B)	7782492	410	4,000	4,000	400	7.8E+7	NLV	NLV	NLV	NLV	5.9E+7	9.6E+6	1.0E+7	1.0E+7	NA
Silver (B)	7440224	1,000	4,500	13,000	100 (M); 27	2.0E+8	NLV	NLV	NLV	NLV	2.9E+6	9.0E+6	9.8E+6	9.4E+6	NA
Silvex (2,4,5-TP)	93721	NA	3,600	3,600	2,200	3.1E+6	NLV	NLV	NLV	NLV	ID	5.5E+6	7.7E+6	6.4E+6	NA
Simazine	122349	NA	80	80	NA	90,000	NLV	NLV	NLV	NLV	ID	3.8E+6	5.3E+6	4.5E+6	NA
Sodium	17341252	NA	2.5E+6	7.0E+6	NA	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	1.0E+9 (D)	1.0E+9 (D)	1.0E+9 (D)	NA
Sodium azide	26628228	NA	1,800	5,000	NA	ID	ID	ID	ID	ID	ID	8.70E+06	1.20E+07	1.00E+07	NA
Strontium (B)	7440246	NA	92,000	2.6E+5	46,000 (X)	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	1.0E+9 (D)	1.0E+9 (D)	1.0E+9 (D)	NA
Styrene	100425	NA	2,700	2,700	2,200	2.7E+5	5.2E+5 (C)	3.3E+6	3.3E+6	4.2E+6	6.9E+9	5.2E+5 (C)	5.2E+5 (C)	5.2E+5 (C)	5.2E+5
Sulfate	14808798	NA	5.0E+6	5.0E+6	NA	ID	NLV	NLV	NLV	NLV	ID	ID	ID	ID	NA
Tebuthiuron	34014181	NA	10,000	30,000	NA	5.0E+7	NLV	NLV	NLV	NLV	ID	2.7E+7 (DD)	4.2E+7 (DD)	3.3E+7 (DD)	NA
2,3,7,8-Tetrabromodibenzo-p-dioxin (O)	50585416	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	(O)	(O)	(O)	(O)	NA
1,2,4,5-Tetrachlorobenzene	95943	NA	1.5E+6	1.5E+6	3,400 (X)	1.5E+6	ID	ID	ID	ID	ID	2.5E+8	3.5E+8	2.9E+8	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin (O)	1746016	NA	NLL	NLL	NLL	NLL	NLV	NLV	NLV	NLV	89 (O)	0.99 (O)	1.4 (O)	2.9 (O)	NA
1,1,1,2-Tetrachloroethane	630206	NA	1,500	6,400	ID (X)	4.4E+5 (C)	33,000	1.2E+5	2.1E+5	3.3E+5	5.3E+8	4.4E+5 (C)	4.4E+5 (C)	4.4E+5 (C)	4.4E+5
1,1,2,2-Tetrachloroethane	79345	NA	170	700	1,600 (X)	94,000	23,000	34,000	34,000	34,000	6.8E+7	2.4E+5	3.4E+5	2.9E+5	8.7E+5
Tetrachloroethylene	127184	NA	100	100	900 (X)	88,000 (C)	60,000	6.0E+5	1.4E+6	3.3E+6	6.8E+9	88,000 (C)	88,000 (C)	88,000 (C)	88,000
Tetrahydrofuran	109999	NA	1,900	5,400	2.2E+5 (X)	3.2E+7	2.4E+6	1.5E+7	6.7E+7	1.6E+8	1.7E+11	9.5E+6	1.3E+7	1.1E+7	1.2E+8
Tetranitromethane	509148	NA	ID	ID	ID	ID	600	500 (M); 180	ID	ID	2.6E+5	ID	ID	ID	ID
Thallium (B)	7440280	NA	2,300	2,300	4,200 (X)	1.5E+7	NLV	NLV	NLV	NLV	ID	1.3E+5	1.4E+5	1.3E+5	NA
Toluene (I)	108883	NA	16,000	16,000	2,800	2.5E+5 (C)	2.5E+5 (C)	3.3E+6	3.6E+7	3.6E+7	1.2E+10	2.5E+5 (C)	2.5E+5 (C)	2.5E+5 (C)	2.5E+5
p-Toluidine	106490	NA	660 (M); 300	1,200	NA	4.8E+5	NLV	NLV	NLV	NLV	1.3E+8	4.3E+5	6.1E+5	5.1E+5	1.2E+6
Toxaphene	8001352	NA	24,000	24,000	860	3.6E+5	NLV	NLV	NLV	NLV	1.2E+7	85,000	1.5E+5	1.1E+5	NA
Triallate	2303175	NA	95,000	2.5E+5 (C)	NA	2.5E+5 (C)	ID	ID	ID	ID	ID	2.5E+5 (C)	2.5E+5 (C)	2.5E+5 (C)	2.5E+5
Tributylamine	102829	NA	7,800	23,000	ID	1.8E+6	1.1E+6	7.2E+5	7.2E+5	7.2E+5	2.1E+8	2.6E+6	3.6E+6	3.0E+6	3.7E+6



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

Guidesheet Number →			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
#10			#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
1,2,4-Trichlorobenzene	120821	NA	4,200	4,200	1,800	1.1E+6	1.1E+6 (C)	3.4E+7	3.4E+7	3.4E+7	1.1E+10	1.1E+6 (C,DD)	1.1E+6 (C,DD)	1.1E+6 (C,DD)	1.1E+6
1,1,1-Trichloroethane	71556	NA	4,000	4,000	4,000	4.6E+5 (C)	4.6E+5	4.5E+6	1.5E+7	3.1E+7	2.9E+10	4.6E+5 (C)	4.6E+5 (C)	4.6E+5 (C)	4.6E+5
1,1,2-Trichloroethane	79005	NA	100	100	6,600 (X)	4.2E+5	24,000	57,000	57,000	1.2E+5	2.5E+8	8.4E+5	9.2E+5 (C)	9.2E+5 (C)	9.2E+5
Trichloroethylene	79016	NA	100	100	4,000 (X)	4.4E+5	37,000	2.6E+5	4.4E+5	1.1E+6	2.3E+9	5.0E+5 (C,DD)	5.0E+5 (C,DD)	5.0E+5 (C,DD)	5.0E+5
Trichlorofluoromethane	75694	NA	52,000	1.5E+5	NA	5.6E+5 (C)	5.6E+5 (C)	1.1E+8	1.4E+11	1.4E+11	1.7E+12	5.6E+5 (C)	5.6E+5 (C)	5.6E+5 (C)	5.6E+5
2,4,5-Trichlorophenol	95954	NA	39,000	1.1E+5	NA	9.1E+6	NLV	NLV	NLV	NLV	1.0E+10	7.3E+7	1.0E+8	8.6E+7	NA
2,4,6-Trichlorophenol	88062	NA	2,400	9,400	330 (M); 100	2.0E+5	NLV	NLV	NLV	NLV	1.3E+9	3.3E+6	4.6E+6	3.9E+6	NA
1,2,3-Trichloropropane	96184	NA	840	2,400	NA	8.3E+5 (C)	ID	ID	ID	ID	ID	8.3E+5 (C)	8.3E+5 (C)	8.3E+5 (C)	8.3E+5
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	NA	5.5E+5 (C)	5.5E+5 (C)	1,700	5.5E+5 (C)	5.5E+5 (C)	2.1E+8	8.9E+8	2.1E+9	2.3E+12	5.5E+5 (C)	5.5E+5 (C)	5.5E+5 (C)	5.5E+5
Triethanolamine	102716	NA	74,000	2.0E+5	NA	1.1E+8 (C)	NLV	NLV	NLV	NLV	1.5E+9	1.1E+8 (C)	1.1E+8 (C)	1.1E+8 (C)	1.1E+8
Triethylene glycol	112276	NA	1.1E+5 (C)	1.1E+5 (C)	NA	1.1E+5 (C)	NLV	NLV	NLV	NLV	ID	1.1E+5 (C,DD)	1.1E+5 (C,DD)	1.1E+5 (C,DD)	1.1E+5
3-Trifluoromethyl-4-nitrophenol	88302	NA	1.1E+5	3.1E+5	NA	1.2E+8	NLV	NLV	NLV	NLV	ID	2.4E+8 (DD)	3.7E+8 (DD)	3.0E+8 (DD)	NA
Trifluralin	1582098	NA	1.9E+5	5.7E+5	NA	1.2E+7	ID	ID	ID	ID	ID	5.7E+6	1.0E+7	7.4E+6	NA
2,2,4-Trimethyl pentane	540841	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	19,000
2,4,4-Trimethyl-2-pentene (I)	107404	NA	ID	ID	NA	ID	ID	ID	ID	ID	ID	ID	ID	ID	56,000
1,2,4-Trimethylbenzene (I)	95636	NA	2,100	2,100	570	1.1E+5 (C)	1.1E+5 (C)	2.5E+7	6.0E+8	6.0E+8	3.6E+10	1.1E+5 (C)	1.1E+5 (C)	1.1E+5 (C)	1.1E+5
1,3,5-Trimethylbenzene (I)	108678	NA	1,800	1,800	1,100	94,000 (C)	94,000 (C)	1.9E+7	4.6E+8	4.6E+8	3.6E+10	94,000 (C)	94,000 (C)	94,000 (C)	94,000
Triphenyl phosphate	115866	NA	1.1E+5 (C)	1.1E+5 (C)	NA	1.1E+5 (C)	NLV	NLV	NLV	NLV	ID	1.1E+5 (C)	1.1E+5 (C)	1.1E+5 (C)	1.1E+5
tris(2,3-Dibromopropyl)phosphate	126727	NA	930	930	NA	27,000 (C)	27,000 (C)	60,000	60,000	60,000	7.4E+6	20,000	27,000 (C)	24,000	27,000
Urea	57136	NA	ID (N)	ID (N)	NA	ID	NLV	NLV	NLV	NLV	ID	ID	ID	ID	NA
Vanadium	7440622	NA	72,000	9.9E+5	1.9E+5	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	5.5E+6 (DD)	6.2E+6 (DD)	5.9E+6 (DD)	NA
Vinyl acetate (I)	108054	NA	13,000	36,000	NA	2.4E+6 (C)	1.5E+6	2.0E+6	2.7E+6	5.9E+6	5.9E+9	2.4E+6 (C,DD)	2.4E+6 (C,DD)	2.4E+6 (C,DD)	2.4E+6
Vinyl chloride	75014	NA	40	40	300	20,000	2,800	29,000	1.7E+5	4.2E+5	8.9E+8	34,000	47,000	40,000	4.9E+5
White phosphorus (R)	12185103	NA	2.2	6.0	NA	58,000	NLV	NLV	NLV	NLV	ID	17,000 (DD)	18,000 (DD)	18,000 (DD)	NA



**TABLE 3. SOIL: INDUSTRIAL AND COMMERCIAL II, III, AND IV  
PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS;  
PART 213 TIER 1 RISK-BASED SCREENING LEVELS (RBSLs)**

			Groundwater Protection				Indoor Air	Ambient Air (Y)				Direct Contact			
Guidesheet Number →		#10	#21		#12	#13	#22	#23	#24	#25	#26	#27	#28	#29	#30
Hazardous Substance	Chemical Abstract Service Number	Statewide Default Background Levels	Residential Drinking Water Protection Criteria & RBSLs	Industrial and Commercial Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria & RBSLs	Groundwater Contact Protection Criteria & RBSLs	Soil Volatilization to Indoor Air Inhalation Criteria & RBSLs	Infinite Source Volatile Soil Inhalation Criteria (VSIC) & RBSLs	Finite VSIC for 5 Meter Source Thickness	Finite VSIC for 2 Meter Source Thickness	Particulate Soil Inhalation Criteria & RBSLs	Industrial and Commercial II	Commercial III	Commercial IV	Soil Saturation Concentration Screening Levels
Xylenes (I)	1330207	NA	5,600	5,600	700	1.5E+5 (C)	1.5E+5 (C)	5.4E+7	6.5E+7	1.3E+8	1.3E+11	1.5E+5 (C)	1.5E+5 (C)	1.5E+5 (C)	1.5E+5
Zinc (B)	7440666	47,000	2.4E+6	5.0E+6	(G)	1.0E+9 (D)	NLV	NLV	NLV	NLV	ID	6.3E+8	6.9E+8	6.6E+8	NA

## Former L.A. Darling Facility - Soil Cleanup Criteria for Excavation

## TABLE 9

Chemical of Concern - Soil	Soils Min.	Soils Max.	Units	Is contaminant found in GW ?	Maximum GW Concentration	Units	Is GW concentration > GSI ?	Most Stringent Soil ARAR	Conc.	Units
Chloroethane										
1,1-Dichloroethane										
1,2-Dichloroethane										
1,1-Dichloroethene	2,700	2,700	ppb	No				Direct Contact	$5.75 \times 10^5$	ppb
cis-1,2-Dichloroethene	8.1	340,000	ppb	Yes	6,300 (VAS)	ppb	Yes	GSI Protection	12,000	ppb
trans-1,2-Dichloroethene	23	4,500	ppb	Yes	23 (VAS)	ppb	No	Direct Contact	$1.4 \times 10^6$	ppb
1,1,2,2-Tetrachloroethane										
Tetrachloroethene	13	6,900	ppb	Yes	14 (VAS)	ppb	No	Direct Contact	88,000	ppb
1,1,1-Trichloroethane										ppb
1,1,2-Trichloroethane										ppb
Trichloroethene	11	380,000	ppb	Yes	43,000 (VAS)	ppb	Yes	GSI Protection Criteria	4,000	ppb
Vinyl chloride	71	1,100	ppb	Yes	110 (VAS)	ppb	Yes	GSI Protection Criteria	300	ppb
Arsenic	600	880,000	ppb	Yes	17.6 (VAS)	ppb	No	Direct Contact	37,000	ppb
Barium	4,000	3,900,000	ppb	Yes	220 (VAS)	ppb	No	Direct Contact	$1.3 \times 10^8$	ppb
Cadmium	52	15,000,000	ppb	Yes	470 (VAS)	ppb	Yes	GSI Protection Criteria (Soil/Water Partition Coefficient) or Site-Specific Background	7400*	ppb
Chromium (III)	3,900	110,000,000	ppb	Yes	1,200.0	ppb	No	Direct Contact	$1 \times 10^9$	ppb
Hexavalent Chromium	790	66,000	ppb	No				Direct Contact	$9.2 \times 10^6$	ppb
Copper	3,300	67,000,000	ppb	Yes	500 (VAS)	ppb	Yes	GSI Protection Criteria (Soil/Water Partition Coefficient) or Site-Specific Background	170000*	ppb
Lead	2,600	13,000,000	ppb	Yes	61 (VAS)	ppb	No	Direct Contact	400,000	ppb
Selenium	100	2,900	ppb	Yes	15.0	ppb	Yes	State Background	410	ppb
Silver	110	280,000	ppb	Yes	0.3	ppb	Yes	State Background	1,000	ppb
Zinc	7,200	9,000,000	ppb	Yes	200 (VAS)	ppb	No	Direct Contact	$6.3 \times 10^8$	ppb
Mercury	72	25,000	ppb	No				Direct Contact	$5.8 \times 10^5$	ppb
Cyanide	1.1	4,200,000	ppb	Yes	360.0	ppb	Yes	GSI Protection Criteria (or Site-Specific Background)	100	ppb

\* Note: Soil/Water Partition Coefficients are subject to review by MDEQ and U.S. EPA.

## Table 10

COST ESTIMATE COMPARISONS FOR REMEDIATION ALTERNATIVES - SOILS												
FORMER LAD FACILITY OU2												
BRONSON, MICHIGAN												
	Soils Excavation & Off-Site Disposal <sup>(1)(2)</sup>				In-Situ Soil Stabilization <sup>(1)(2)</sup>				Soil Vapor Extraction <sup>(1)(2)</sup>			
ITEM and DESCRIPTION	#	UNIT	UNIT COST	EXTENDED COST	#	UNIT	UNIT COST	EXTENDED COST	#	UNIT	UNIT COST	EXTENDED COST
<b>Engineering Capital Costs</b>												
Remedial Design	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000
Water tower geotechnical investigation	1	event	\$2,000	\$2,000	1	event	\$2,000	\$2,000	1	event	\$2,000	\$2,000
Remediation verification sample analyses	25	sample	\$225	\$5,625	25	sample	\$225	\$5,625	25	sample	\$225	\$5,625
Report preparation	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000
UST closure documentation and report	1	process	\$5,000	\$5,000	1	process	\$5,000	\$5,000	1	process	\$5,000	\$5,000
<b>Contractor Capital Costs</b>												
Contractor mobilization/demobilization	1	event	\$10,000	\$10,000	1	event	\$10,000	\$10,000	1	event	\$5,000	\$5,000
Site preparation	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000
Equipment and facilities	3	month	\$7,500	\$22,500	3	month	\$7,500	\$22,500				
Vacuum Extraction Equipment									1	l.s.	\$ 45,950	\$ 45,950
UST and contaminated soils off-site disposal	1	UST	\$25,000	\$25,000	1	UST	\$25,000	\$25,000	1	UST	\$25,000	\$25,000
Excavate/stage/load soil and concrete overburden - Level C PPE	2,770	cubic yard	\$22	\$60,940								
In-situ injection and mixing proprietary reactant					2,770	cubic yard	\$278	\$769,847				
Installation of soil vapor extraction well systems									7	wells	\$ 9,000	\$ 63,000
T&D to local hazardous wastes landfill	3,463	ton	\$87	\$301,281								
Import backfill for excavation cavities and grade	2,770	cubic yard	\$9	\$24,930								
Surveying to confirm contractor payment volumes	2	event	\$2,500	\$5,000								
Drainage and dewatering controls	3	month	\$2,500	\$7,500								
Site restoration	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000
Security controls and HASP	3	month	\$5,000	\$15,000	3	month	\$5,000	\$15,000	3	month	\$5,000	\$15,000
Dust control and Air Monitoring	3	month	\$5,000	\$15,000	3	month	\$5,000	\$15,000	3	month	\$5,000	\$15,000
Engineering construction management	1	l.s.	\$36,000	\$36,000	1	l.s.	\$36,000	\$36,000	1	l.s.	\$20,000	\$20,000
<b>Contingency</b>												
Contingency (0.05 x (engineering costs + contractor costs))	1	5%	\$27,789	\$27,789	1	5%	\$46,299	\$46,299	1	5%	\$11,079	\$11,079
<b>Total Capital Cost</b>				<b>\$583,566</b>	<b>\$972,270</b>				<b>\$ 232,680</b>			
<b>Operation and Maintenance Costs</b>												
	5	year	\$8,000	\$40,000	10	year	\$15,000	\$120,000	4.8	year	\$ 120,000	\$ 576,000
<b>TOTAL ESTIMATED COST SOILS ALTERNATIVE</b>				<b>\$623,566</b>	<b>\$1,092,270</b>				<b>\$808,680</b>			
(1) Cost estimate does not include annual costs for on-site groundwater remediation and monitoring.												
(2) Cost estimate reflects monies previously spent "at-risk" during Contaminated Soils Removal Activities performed in 2007, which totalled \$1,550,025.												

## Table 11

COST ESTIMATE COMPARISONS FOR REMEDIATION ALTERNATIVES - GROUNDWATER												
FORMER LAD FACILITY OU2												
BRONSON, MICHIGAN												
ITEM and DESCRIPTION	Air Stripping with SVE/AS - Groundwater				Granular Activated Carbon - Groundwater				Chemical Oxidation - Groundwater			
	#	UNIT	UNIT COST	EXTENDED COST	#	UNIT	UNIT COST	EXTENDED COST	#	UNIT	UNIT COST	EXTENDED COST
<b>Engineering Capital Costs</b>												
Remedial Design	1	event	\$10,000	\$10,000	1	event	\$10,000	\$10,000	1	event	\$35,000	\$35,000
5,000 Gal. Field Pilot Test	1	event	\$5,000	\$5,000	1	event	\$5,000	\$5,000	1	event	\$10,000	\$10,000
Laboratory Fees	26	sample	\$225	\$5,850	52	sample	\$225	\$11,700	52	sample	\$225	\$11,700
Report preparation	1	event	\$14,000	\$14,000	1	event	\$25,000	\$25,000	1	event	\$25,000	\$25,000
<b>Contractor Capital Costs</b>												
Contractor mobilization/demobilization	1	event	\$15,000	\$15,000	1	event	\$15,000	\$15,000	1	event	\$15,000	\$15,000
Site preparation, concrete slab and fence	1	event	\$35,000	\$35,000	1	event	\$35,000	\$35,000	1	event	\$35,000	\$35,000
Groundwater recovery wells	7	unit	\$9,300	\$65,100	7	unit	\$9,300	\$65,100	7	unit	\$9,300	\$65,100
Groundwater recovery pumps, piping & trenching	1	l.s.	\$48,000	\$48,000	1	l.s.	\$48,000	\$48,000	1	l.s.	\$48,000	\$48,000
Filtration units, pre and post treatment	2	unit	\$10,000	\$20,000	2	unit	\$15,000	\$30,000	2	unit	\$10,000	\$20,000
Equilization tank	1	unit	\$3,500	\$3,500	1	unit	\$5,000	\$5,000	1	unit	\$3,500	\$3,500
Air stripping unit, 35 gpm installed with 150 cfm air blower	1	unit	\$48,500	\$48,500								
Air sparging well (10) installed with piping & trenching	10	unit	\$2,500	\$25,000								
Air sparging system piping and 150 cfm @ 30 psi compressor	1	unit	\$55,000	\$55,000								
Soil vapor extraction wells (10) installed with piping & trenching	10	unit	\$1,750	\$17,500								
Carbon contact units packed bed downflow @ 100 cu. ft.					2	unit	\$55,000	\$110,000	2	unit	\$55,000	\$110,000
Post adsorption chemical precipitation tanks with chlorination					2	unit	\$45,000	\$90,000				
Hy-Pox System with 25 #/day Ozone generator @ 35 gpm									1	unit	\$ 194,683	\$ 200,675
Effluent discharge piping to storm sewer	1	unit	\$2,300	\$2,300	1	unit	\$5,000	\$5,000	1	unit	\$2,300	\$2,300
Site restoration	1	event	\$3,000	\$3,000	1	event	\$3,000	\$3,000	1	event	\$3,000	\$3,000
Security controls and HASP	1	month	\$5,000	\$5,000	4	month	\$5,000	\$20,000	1	month	\$5,000	\$5,000
Engineering construction management	1	l.s.	\$35,890	\$35,890	1	l.s.	\$35,750	\$35,750	1	l.s.	\$35,890	\$35,890
<b>Contingency</b>												
Contingency (0.1 x (engineering costs + contractor costs))	1	l.s.	\$41,364	\$41,364	1	l.s.	\$51,450	\$51,450	1	10%	\$62,520	\$62,520
<b>Total Capital Cost</b>				<b>\$455,000</b>				<b>\$565,000</b>				<b>\$687,695</b>
<b>Operation and Maintenance Costs</b>	30	year	\$114,500	<b>\$916,000</b>	30	year	\$186,000	<b>\$1,488,000</b>	30	year	\$ 97,000	<b>\$ 776,000</b>
<b>TOTAL ESTIMATED COST GROUNDWATER ALTERNATIVE</b>				<b>\$1,371,000</b>	<b>\$2,053,000</b>				<b>\$1,463,695</b>			
Present Worth Factor 30 years Operation and Maintenance = 8.0												

**Former L.A. Darling Facility**  
**Operable Unit 2**  
**of the**  
**North Bronson Former Facilities Site**  
**Bronson, Michigan**

**Appendix B**  
**to the**  
**Record of Decision**

**CONCURRENCE LETTER**  
**FROM THE**  
**STATE OF MICHIGAN**



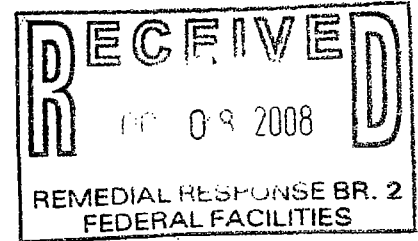
JENNIFER M. GRANHOLM  
GOVERNOR

STATE OF MICHIGAN  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
LANSING



STEVEN E. CHESTER  
DIRECTOR

September 30, 2008



Mr. Richard C. Karl, Director  
Superfund Division  
United States Environmental Protection Agency  
Region 5  
77 West Jackson Boulevard (S-6J)  
Chicago, Illinois 60604-3507

Dear Mr. Karl:

SUBJECT: Record of Decision (ROD) for the Former L.A. Darling Facility Operable Unit 2 of the North Bronson Former Facilities Site in Bronson, Michigan dated September 2008

The Michigan Department of Environmental Quality (MDEQ), Remediation and Redevelopment Division (RRD), concurs with the remedies contained in the above-referenced ROD with the following caveats.

The ROD stipulates several land/resource use restrictions will be implemented to prevent unacceptable exposure to site contaminants. The MDEQ's concurrence is dependent upon the completion and filing of deed restrictions with the county register of deeds upon all properties identified as being former L.A. Darling plant properties adequately addressing the following:

- Use of on-site groundwater is prohibited unless or until groundwater treatment has resulted in the attainment of Part 201<sup>1</sup> cleanup criteria that are compatible with the land use. The groundwater criteria are to be stipulated in a subsequent ROD. Unless the selected site groundwater cleanup criteria are generic residential drinking water, groundwater use will still need to be restricted to the appropriate level of cleanup.
- For parcels where surface or subsurface concrete foundations and floors remain, deed restrictions must contain provisions for proper management of concrete, should it be determined to be contaminated.
- Holders of easements to the property must be identified and notified at least biennially of the potential risks posed by contamination remaining on-site.

<sup>1</sup>Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

**Former L.A. Darling Facility**  
**Operable Unit 2**  
**of the**  
**North Bronson Former Facilities Site**  
**Bronson, Michigan**

**Appendix C**  
**to the**  
**Record of Decision**

**RESPONSIVENESS SUMMARY**

## **Responsiveness Summary**

### **Former L.A. Darling Facility Operable Unit #2 of the North Bronson Former Facilities Site Bronson, Michigan**

In July of 2008, U.S. EPA issued a Proposed Plan Fact Sheet for the Former L.A. Darling Facility, which is Operable Unit #2 of the North Bronson Former Facilities Site in Bronson, Michigan. This Proposed Plan provided information on U.S. EPA's recommended cleanup plan, the availability of the Remedial Investigation Report and the Feasibility Study, and details concerning the upcoming public meeting. Over three hundred copies of the Proposed Plan were distributed to nearby residents and interested parties. In addition, a notice was placed in the Coldwater Daily Reporter on July 16, 2002 to further publicize the comment period and U.S. EPA's public meeting.

On August 7, 2008, U.S. EPA held a public meeting to discuss the alternatives being considered for the former L.A. Darling Facility. U.S. EPA presented information on the history of the Site, described the alternatives and presented U.S. EPA's recommended soil and groundwater alternatives. During the meeting, U.S. EPA accepted oral comments on the proposed alternatives. The Bronson City Manager provided the only oral comment received at the meeting.

From July 17, 2008 until August 15, 2008, U.S. EPA accepted public comments on the proposed alternatives for the Former L.A. Darling Facility. Two written comments were received from nearby residents. Two e-mail comments were received from the ITT Corporation, a Potentially Responsible Party for the former Bronson Reel Facility, which is Operable Unit #1 of the NBFF Site. Although the ITT comments were received after the close of the public comment period, U.S. EPA is including the comments as part of this Responsiveness Summary.

U.S. EPA reviewed all oral and written comments. Significant comments are summarized and addressed in this Responsiveness Summary.

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#### **Oral Comment from the City of Bronson**

**During the public meeting Mr. David O'Rourke, Bronson City Manager noted his good working relationship with the Potentially Responsible Party, and expressed frustration at the time it has taken to get to a cleanup.**

Response: U.S. EPA notes that the City is pleased with its interactions with the L.A. Darling Company. U.S. EPA further notes the City's frustration concerning the length of time necessary to get to a cleanup.

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#### **Written Comments from the General Public**

**U.S. EPA received two written comments from residents.**

- **Resident #1 stated that if the public needs to pay for the cleanup, nothing should be done. However, if the responsible company is to perform the work, the resident stated that the cleanup should be performed.**

Response: U.S. EPA plans on working with the L.A. Darling Company for the performance of the cleanup.

- **Resident #2 expressed support for U.S. EPA's recommended cleanup alternatives. Resident #2 also expressed concern regarding how much contamination has already been released into the environment and stated that it may be too late since so much damage has already been done.**

Response: U.S. EPA notes the resident's support for the recommended alternatives. The soil cleanup work at the Former L.A. Darling Facility should return the property to a condition that is safe for commercial / industrial development. However, returning groundwater in the area to a condition safe for consumption will take many years. The interim groundwater work at the Former L.A. Darling facility is meant to reduce the mass of VOCs at the source and ultimately contain contaminated groundwater within the Facility boundary. The ROD for the Former L.A. Darling Facility will be followed by a cleanup decision for the Former Scott Fetzer Facility and an evaluation of cleanup options for the remainder of the groundwater contaminant plume.

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**Written Comments (via e-mail) from the ITT Corporation**

- ***ITT Comment #1 – "One of the stated goals of the plan is "to stop contaminated ground water from moving beyond the property boundary..." The proposed plan includes excavation of contaminated soil and subsurface structures to the top of the water table, combined with AS/SVE for up to five years (first phase) followed by groundwater pump and treat (second phase). Both soil excavation and AS/SVE are source control measures. The groundwater pump and treat, as described in the Streamlined Feasibility Study, likewise would be centered on the source areas. While the proposed plan will address the known sources of contamination on the property, there is no provision for preventing contaminated groundwater from continuing to migrate off-site until the source areas are mitigated. The proposed plan should include continued monitoring of groundwater quality near the perimeter of the site to assess concentrations leaving the property, and should otherwise address contaminated groundwater that has migrated and will continue to migrate off-site."***

Response: The focus of the Former L.A. Darling Facility cleanup is to permanently address soil contamination and commence remediation of the contaminated groundwater. The selected groundwater alternative is considered to be an interim remedy. Contaminated groundwater that has moved beyond the facility will be addressed in a separate decision document. The selected interim remedy for groundwater will include routine monitoring of groundwater contaminant concentrations.

- ***ITT Comment #2 – "Because the groundwater gradients in the NBIA are typically very low, even small perturbations in the groundwater system may influence groundwater flow direction and plume development. A number of elements included in the proposed plan may affect groundwater elevations in the NBIA:***
  - a. AS/SVE in the source areas may cause a groundwater mound;***
  - b. Groundwater pumping at L.A. Darling may alter groundwater flow in areas beyond the property boundary; and***
  - c. The release of treated groundwater to CD30 via the storm sewer may affect groundwater levels and flow near CD30.***

***The remedial design for the L.A. Darling site should include an analysis of the potential changes in groundwater flow patterns to make sure that any changes in flow will not complicate cleanup***

***efforts in other areas of the NBIA. In addition, groundwater elevations should be monitored regularly during implementation of the remedial actions.”***

Response: Comments noted. The impact of the remedial action will be assessed. Groundwater elevations will be monitored. However, because the groundwater treatment system for the Former L.A. Darling Facility will likely be in place prior to cleanup efforts at the Former Scott Fetzer Facility and at the North Bronson Industrial Area Site, it is anticipated that any other future groundwater remediation systems in the area would be designed to be consistent with new groundwater flow conditions.

**Former L.A. Darling Facility**  
**Operable Unit 2**  
**of the**  
**North Bronson Former Facilities Site**  
**Bronson, Michigan**

**Appendix D**  
**to the**  
**Record of Decision**

**INDEX**  
**TO THE**  
**ADMINISTRATIVE RECORD**

U.S. ENVIRONMENTAL PROTECTION AGENCY  
REMEDIAL ACTION

ADMINISTRATIVE RECORD  
FOR  
NORTH BRONSON FORMER FACILITIES SITE  
OPERABLE UNIT #2 - L.A. DARLING FACILITY  
BRONSON, BRANCH COUNTY, MICHIGAN

ORIGINAL  
MAY 23, 2008  
(SDMS ID: 299646)

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1	04/06/07	Van Donsel, T., U.S. EPA	Wilhelm, R., Haley & Aldrich, Inc.	Letter re: Vapor Intrusion Criteria - North Bronson Former Facilities Site - Former Scott Fetzner Facility (SDMS ID: 299571)	3
2	12/06/07		File	Table 1: L.A. Darling Facility Residential 24 Hour Air Sampling Results (SDMS ID: 299647)	1
3	05/23/08	Theisen, K., U.S. EPA	Karl, R, U.S. EPA	Action Memorandum: Determination of an Im- minent and Substantial Threat to Public Health and Welfare, and to the Environ- ment at the Former L.A. Darling Facility, OU #2 of the North Bronson Former Facilities Site (PORTIONS OF THIS DOCUMENT HAVE BEEN REDACTED, SDMS ID: 299554)	11

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UPDATE #1  
JULY 16, 2008  
(SDMS ID: 299703)

<u>NO.</u>	<u>DATE</u>	<u>AUTHOR</u>	<u>RECIPIENT</u>	<u>TITLE/DESCRIPTION</u>	<u>PAGES</u>
1	02/00/06	Clayton Group Services	L.A. Darling Company	Final Remedial Investi- gation Report for the Former L.A. Darling Facility (Text, Tables, and Figures) (SDMS ID: 299689)	138
2	02/00/06	Clayton Group Services	L.A. Darling Company	Final Remedial Investi- gation Report for the Former L.A. Darling Facility (Appendices) (SDMS ID: 299690)	537
3	06/00/07	Avendt Group	The Marmon Group, Inc.	Streamlined Feasibility Study for the Former L.A. Darling Facility (SDMS ID: 299688)	100

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UPDATE #2  
JULY 24, 2008  
(SDMS ID: 299728)

<u>NO.</u>	<u>DATE</u>	<u>AUTHOR</u>	<u>RECIPIENT</u>	<u>TITLE/DESCRIPTION</u>	<u>PAGES</u>
1	06/14/99	Gerber, B., U.S. Dept. of Justice	Defendants	Consent Decree -Civil Action No. 1:99-C-V-490 (SDMS ID: 274286)	90
2	06/05/02	Muno, W., U.S. EPA	Respondent	Administrative Order by Consent for the L.A. Darling Co. V-W-'02-C-699 (SDMS ID: 164819)	23
3	12/10/04	Hogarth, A., MDEQ	Interested Parties	Memorandum re: RRD Operational Memorandum No. 1, Part 201-Cleanup Criteria and Part 213- Risk Based Screening Levels w/Attachments (SDMS ID: 299722)	60
4	05/17/06	Avendt, R., Avendt Group	Van Donsel, T., U.S. EPA	letter re: Response to Comments in Conditional Approval of the RI Report for the Former L.A. Darling Facility, North Bronson Former Facilities Site (SDMS ID: 299723)	11
5	08/28/07	Avendt, R., Avendt Group	Van Donsel, T., U.S. EPA	Site Specific Work Plan for the Proposed Con- taminated Soils Removal Activities at the Former L.A. Darling Facility, North Bronson Former Facilities Site w/Cover Sheet (SDMS ID: 299724)	18
6	03/12/08	Avendt, R., Avendt Group	Van Donsel, T., U.S. EPA	Letter re: Contaminated Soils Excavation and Re- moval Activities at the Former L.A. Darling Facility, North Bronson Former Facilities Site w/Attachments (SDMS ID: 299725)	4

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7	03/26/08	Knoepfle, J., SulTRAC	Van Donsel, T., U.S. EPA	Final Summary Oversight Report of PRP Voluntary Removal Action Field Activities for Nov. 14, 2007 through Feb. 4, 2008 at the Former L.A. Darling Facility, North Bronson Former Facilities Site w/Attachments <b>(SDMS ID: 299726)</b>	125
8	05/23/08	Karl, R., U.S. EPA	Respondent	Administrative Order for the L.A. Darling Co. V-W-'08-C-901 w/Attach- ments (SDMS ID: 291301) <b>(SDMS ID: 291301)</b>	370
9	07/00/08	U.S. EPA	Public	U.S. EPA Fact Sheet: Cleanup Plan Proposed for Soil, Underground Water at the Former L.A. Darling Site (Proposed Plan) <b>(SDMS ID: 299727)</b>	9

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UPDATE #3  
SEPTEMBER 17, 2008

<u>NO.</u>	<u>DATE</u>	<u>AUTHOR</u>	<u>RECIPIENT</u>	<u>TITLE/DESCRIPTION</u>	<u>PAGES</u>
1	07/16/08	The Daily Reporter	Public	News Release: EPA Invites Your Comments on the L.A. Darling Cleanup Project	1
2	08/07/08	Depobook Court Reporting Services	U.S. EPA	Public Meeting Transcript: Public Hearing for Former L.A. Darling Facility in Bronson, Michigan	38
3	08/07/08	Residents, City of Bronson	U.S. EPA	U.S. EPA Comment Sheets for the Proposed Cleanup Plan for the North Bronson Former Facilities Site - OU2 L.A. Darling Facility	4
4	08/15/08	Mullins, S., ITT	U.S. EPA	Electronic Transmission re: Comments on the Proposed Cleanup Plan for the North Bronson Former Facilities Site - OU2 L.A. Darling Facility	2